SUPPLEMENT
TO THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

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Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 18, 1877.

The Chairman of Committees informed the House that the opposition to the Bolton Improvement Bill was withdrawn.

The Examiner's certificate, in the case of the Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill, so far as it relates to the Bishop Auckland Order, was referred back to the Examiner.

The following Bills were read a second time and committed:—Bishop Auckland District Gas; Southend Gas; United General Gas Company (Limerick); Waterford Gas; Woolwich, Plumstead, and Charlton Consumers Gas.

The Heywood Water Bill was referred to a Select Committee, consisting of Lord Wolverton (chairman), Earl Selkirk, Viscount Leinster, Lord Cloncurry, and Lord Leigh; to meet on Wednesday, June 20.

The Kent Water, Gas and Water Orders Confirmation (Abingdon, &c.), Perth Water, and Ashton-under-Lyne Gas Bills, were referred to a Select Committee, consisting of Lord Winmarleigh (chairman), the Duke of Grafton, Earl Ilchester, Lord Balfour of Birley, and Lord Oranmore and Browne; to meet on Wednesday, June 20.

Petitions were presented against the United General Gas Company (Limerick) Bill from (1) Corporation of Limerick, (2) Limerick Water-Works Company; and against the Waterford Gas Bill from Corporation of Waterford.

TUESDAY, JUNE 19.

A petition against the Waterford Gas Bill was presented from the Waterford Harbour Commissioners.

THURSDAY, JUNE 21.

The Examiners reported that no Standing Order is applicable to the Bishop Auckland Order, confirmed by the Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill, which was then read a second time.

The Select Committee on the Kent Water Bill reported that they had not proceeded with the consideration of the Bill, no parties having appeared in opposition thereto.

HOUSE OF COMMONS.

MONDAY, JUNE 18, 1877.

The Londonderry Gas Bill (Lords) was read a second time and committed.

WEDNESDAY, JUNE 20.

The Gas and Water Orders Confirmation (Brotton, &c.,) Bill (Lords) was considered in committee of the whole House, and reported without amendment.

THURSDAY, JUNE 21.

The Gas and Water Orders Confirmation (Brotton, &c.) Bill (Lords) was read the third time and passed.

PUBLIC HEALTH (METROPOLIS) BILL.

In answer to Sir J. M'GAREL HOGG,

Mr. SCLATER-BOOTH said he had no objection that further time should be taken before the Public Health (Metropolis) Bill went into committee. As he had already explained, the measure was, with little exception, essentially one for the consolidation of the existing law. He proposed to fix the committee for that day week.

THAMES RIVER (PREVENTION OF FLOODS) BILL.

Sir C. DILKE asked the Chairman of the Metropolitan Board of Works on what day he proposed to proceed with the Thames River (Prevention of Floods) Bill.

Sir J. M'GAREL HOGG read in reply a resolution passed by the Metropolitan Board of Works to the effect that the Bill had been rendered so essentially different from that which had been presented to the House by the resolution of the Select Committee, as in their opinion the expenses under it should be paid out of a rate to be levied over the whole metropolitan area, that the Board did not feel justified in proceeding further with it during the present session.

Mr. GRANT-DUFF subsequently reported from the Select Committee, who were instructed to inquire into the most equitable mode of charging and meeting the expenses to be incurred under the Bill: "That they had proceeded to examine the allegations of the Bill, and had taken evidence thereon, which they had directed him to report to the House, together with an appendix. That, the committee having resolved that the most equitable mode of charging and meeting the expenses to be incurred for the prevention of floods within the metropolitan district would be that the works should be carried into effect by the Metropolitan Board of Works, and the expenses paid by a rate levied over the whole metropolitan area, the Metropolitan Board of Works, who were promoting the Bill, had stated to the committee that it was not their intention to proceed with the same. That the committee had therefore agreed to report the Bill, without amendment, to the House."

HOUSE OF COMMONS COMMITTEE.

WEDNESDAY, MAY 16.

(*Before Mr.* D. R. PLUNKET, *Chairman: Mr.* FOLJAMBE, *Mr.* STARKEY, *and Mr.* COURTNEY.)

THE GASLIGHT AND COKE COMPANY BILL.

(*Concluded from p.* 1004.)

Mr. *George William Wigner*, examined by Sir E. BECKETT.

I am an analytical and consulting chemist, and have been making some experiments showing the result of gas burning in London with an average amount of ventilation. I have here a table which shows these results:—

Experiments with Ordinary Coal Gas burnt through Argand, Fishtail, and Bat's-wing Burners under ordinary circumstances, in a Room with a Fair Average Amount of Ventilation.

Mark	B	C	F	G	H	J	M	N	P	T
No. of Experiment	1	2	3	4	5	6	7	8	9	10
Gas consumed	150	140	300	300	350	250	150	110	34	42
Number of Burners going	3	3	8	8	8	6	6	3	1	2
Sulphur in gas per 100 cubic feet	10·30	16·30	9·10	9·00	14·68	18·51	10·50	10·30	13·20	9·60
Equal to sulphuric acid	47·32	68·46	83·73	82·71	157·35	141·71	48·23	34·70	13·74	12·34
Amount recovered as sulphurous acid	—	—	—	—	—	—	—	—	—	—
Amount recovered as sulphuric acid	23·27	40·61	35·30	33·80	35·86	32·48	30·10	20·95	6·03	5·57
Per centage of total sulphur recovered as sulphuric acid	49·10	58·66	42·16	46·91	22·80	22·00	62·40	60·40	44·00	45·10
Cubic feet of air drawn out of room per foot of gas burnt	103·80	125·00	52·50	56·90	55·40	72·60	135·00	106·00	311·00	150·00
Per centage of total sulphur recovered as free sulphuric acid	26·70	38·10	26·90	25·10	13·50	12·70	45·70	46·70	12·70	23·40

To make that table intelligible, I should say that these experiments differ from the experiments of Dr. Odling and Dr. Stevenson, inasmuch as, instead of drawing a small sample of air from the centre of the room and testing that, I have ventilated the experimental room in which these experiments have been carried on through a ventilator of fair average size—that is 6 inches square—and have actually tested the whole of the air escaping from the room during the whole time the gas was burning. In the worst experiment out of ten which I made, I had recovered 22 per cent. of the sulphur present in the gas in the form of sulphuric acid; and in the best experiment I collected 62 per cent. in the form of sulphuric acid. The experiments differed slightly in the conditions under which they were carried on, mainly in the number of burners which were used. Instead of allowing the ventilation of the room to take place through an ordinary Arnott ventilator, which would be at the top of the fireplace, close to the ceiling, I drew the whole of the escaping air from the room by means of a steam exhauster, worked by a steam boiler, through a series of glass tubes, made of plate glass, and of an area of about 6 inches, and in those glass tubes I suspended various articles on which I wanted to test the effects of the product. Those tubes would make a total length of about 15 or 16 inches, so that the air, or, rather, the products of combustion, in the passage through the tubes became cold; therefore the articles which I exposed so as to test the character of the products were not exposed to hot air. They were not exposed even to the temperature which would be at the ceiling of the room; but the temperature very rarely exceeded 80°, and sometimes was only 65°. I then passed those products of combustion further through a series of cylinders of about 18 inches or 1 foot 9 inches long, each full of glass marbles and bubbles—those glass marbles and bubbles being kept wet with water, or with different solutions, so as to absorb the acid, and so on, which might be given off—and again I passed them into a second long glass tube, so that any further deposit might take place from them, and then finally they escaped through the steam exhauster into the chimney. Therefore, I first of all cooled the products of combustion by letting them pass through the tube; secondly, I passed them over certain materials; thirdly, absorbed, as much as I could, the sulphuric or sulphurous acid produced; fourthly, I allowed them to deposit any moisture carried away; and fifthly, passed them up into the chimney; and the net results of all these experiments is—and I have carried them on altogether for 18 entire days—that during those 18 entire days there has not been drawn through this ventilator, as I call it, for want of a better name, at the top of the room, enough sulphurous acid to discolour in the slightest degree a piece of iodic acid and starch paper. In other words, I am quite justified in saying that there has been no sensible or appreciable amount of sulphurous acid produced. On the other hand, taking the sulphuric acid, I have recovered different per centages, varying from 22 to 62 per cent. of the sulphur present in the gas in the form of sulphuric acid. Thus, on the particular day on which I got the best results, I burnt 150 cubic feet of gas. Six burners were used, of which two were Argands, two were bat's-wings of different kinds, and two were fishtails, and the gas contained 10·50 grains of sulphur per 100 cubic feet, which would be equivalent to 48·23 grains of sulphuric acid. I actually recovered from it, in the form of sulphuric acid, 30·10 grains, which is 62 per cent. of sulphur present; and of this 62 per cent., 46 per cent. was recovered as free acid; that is, sulphuric acid. I have here a sample of a bit of iodic and starch paper,

which I exposed in this apparatus to the products of combustion of some 50 feet of gas per hour for 20 hours—that is 1000 feet of gas [producing the same]. Sulphurous acid will discolour that paper, and will turn it blue directly; and here is the other [producing another sample], which is obtained by combustion, in an open vessel, of only 5 grains of bisulphide of carbon, in a room of a similar size. I observed Dr. Tidy's statement about the sulphur matches yesterday, and have made some experiments upon that subject since. I have no doubt whatever that Dr. Tidy's evidence was perfectly correct as far as regarded sulphur matches; but they are things which are perfectly unused in London now.

The CHAIRMAN: We need not go any further into this business.

Sir E. BECKETT said he did not wish to do so, only Dr. Tidy seemed to think it of consequence.

Cross-examined by Mr. RICHARDS: I am public analyst for three districts, Gas Examiner of Greenwich, a Fellow of the Chemical Society, and a Fellow of the Society of Public Analysts, but am not connected with any hospital.

Mr. RICHARDS: If sulphuric acid is present in the quantities you describe, would you not expect to find it depositing itself in the lower parts of the room, rather than rising to the ventilator?

Witness: To a very small extent. During those experiments I placed at the ceiling of my room, which is about 10 feet 6 inches high, a small circular plate of ground glass, whitewashed each morning with pure precipitated lime and distilled water, and each evening this plate was taken down, and the whitewash on it carefully scraped off and tested, in order to find the amount of carbonate of lime which had been converted into sulphate, and I found I had as much as 7-100ths or 8-100ths, and, in one case, 13-100ths of a grain, on a small plate about 4 inches round, converted into sulphate of lime, showing that sulphuric acid was present in the air. I further placed at the entrance to the Arnott ventilator, to use the same term, a flask of ice and salt, much in the same way as Mr. Heisch described in his evidence, and I collected on that sometimes as much as three-fourths of a grain of sulphuric acid during the day's experiment.

Am I right in saying that a certain amount of sulphuric acid would be deposited as the vapour passes through the ventilator?—Certainly.

Sulphuric acid itself does not remain in a vapour at the ordinary temperature?—In small quantities, precisely as water does—water remains in a vapour.

Were the experiments that you made in this room repeated from time to time?—Eighteen times.

By the time you performed your eighteenth experiment, all the pictures, and walls, and so on, were entirely destroyed?—There were no pictures. The walls were papered, but they were not destroyed.

Let me call your attention to a statement made by Dr. Odling on the Crystal Palace Bill, which was: "I should say, as regards the general result of my own observations, that of the very small proportion of sulphurous products that are produced, about one-tenth part of that small proportion is converted into a state of sulphuric acid, and that is in a large measure neutralized by the ammonia existing in the air." What do you say to that?—I say I entirely disagree with that, and I will give my reasons for so doing.

Sir E. BECKETT: He says, "I should say." I call that a guess.

Mr. RICHARDS: I do not. I call it an assertion, as used in ordinary conversation. (To witness:) I will now take you to Dr. Thomas Stevenson, who had made experiments with the sulphur in gas, and who found that on burning the gas only about 5 per cent., or the 20th portion, of the sulphur in the gas, as determined by the Referees apparatus, was directly converted during combustion into sulphuric acid, and that most of that sulphuric acid was neutralized by the ammonia present in the gas and in the atmosphere.

Witness: I not only dispute that, but I say that Dr. Stevenson's own evidence deliberately contradicts it.

It is a great blessing that chemistry is an inexact science?—If you refer to Dr. Stevenson's evidence you will find that, so far from bringing out 5 per cent., he himself brings out 40 per cent.; and, in the same way, if you work out Dr. Odling's, you get 60 per cent. The apparatus I used was the ordinary Referees test for determining the sulphur.

Re-examined by Sir E. BECKETT: From the table handed in by Dr. Odling, taking the grains of sulphur per 100 cubic feet of air, in a room of 3800 cubic feet, where the gas had been burning for upwards of five hours at the rate of 15 cubic feet per hour, it was found, at a height of 1 foot 6 inches from the ceiling, to give a mean of 0·160 of a grain per cubic foot; at a height of 5 feet 6 inches from the floor, 0·056; at a height of 3 feet 6 inches from the floor, 0·059. If, in the first instance, the mean of those results was taken, and multiplied by 3800 cubic feet—the capacity of the room—that would amount to a total of 3·32 grains of sulphur contained in the room in the form of sulphur products at one time, which would be just as much as would be produced by gas burning for 40 consecutive minutes. In other words, if the room was ventilated so badly—and it would be extremely bad ventilation if the air was only changed once in 40 minutes—all the sulphuric acid formed by the combustion of the sulphur would be found in that air, according to the results of Dr. Stevenson and Dr. Odling.

Sir E. BECKETT: I have gone over the figures, and I make the same results.

Witness: I take it further, and if you go on to Dr. Stevenson's experiments you find that he carried those experiments on in his drawing-room, which differs apparently 40 feet in capacity from the experiment-room which was used by Dr. Odling and Dr. Russell; and, if you take that room as being something like the same shape, and multiply out the surface area of the walls and ceiling, and take the average deposit of combined and free sulphuric acid on the different plates which Dr. Stevenson exposed, the average amount deposited on the walls will equal 3·05 grains of sulphur, or 9·42 grains of sulphuric acid per hour; and, if you add those two results together, they will come in excess of the total amount of sulphur present in the gas, and Dr. Odling and Dr. Russell's alone are as high as my best results. Dr. Stevenson's results are about 42 per cent., which is about my average.

In short, you agree?—When the figures are properly worked out, the experiments are the most striking confirmation of the presence of acid that you can have.

Gases diffuse freely among vapours, do they not; and although sulphuric acid is heavier than common vapour, it diffuses quite freely through it?—Quite so. Water is heavier than common air, and yet we know that the air is partially saturated with watery vapours.

Mr. MICHAEL: Do I understand you mean to say that the sulphuric acid exists in a room in the form of vapour?—Certainly, as water does.

The COMMITTEE: Have you made any experiments of the process of purification of these sulphur compounds by peroxide of iron?

Witness: I have made no special experiment on that, but I am pretty fairly aware of the general results.

Are you able to say what degree of purity from the sulphur compounds can be attained by the use of the peroxide of iron process, if properly carried out, without having recourse to the lime process?—That would depend a very great deal upon the character of the coal used; but taking the average character of the coal used in the London gas-works, I have no doubt that 33 grains, or 35 grains, may very easily be accomplished.

As an average?—Yes, as an average; and perhaps you might even say 37 or 38 grains as a maximum; but if coal of a sulphurous character is used, it would be very greatly increased.

Mr. *Thomas William Keates*, examined by Sir E. BECKETT.

I was examined upon the Crystal Palace Gas Bill, but wish to say a word about the lime produced just now by Mr. Anderson. I have made an examination of that lime, and find it is almost free from sulphuretted hydrogen. The object of the process, as he has explained, is to draw the sulphuretted hydrogen away from the lime, and that is most effectually done here. These two samples [producing the same] represent the different layers of the purifiers. The one which was exhibited to the committee represents the upper layer, and this, which is in a damper form, having the very same smell, represents the lower layer. In the upper layer there was only ·33 of sulphide of calcium present; in the lower layer only ·45; so that practically it is free from sulphide of calcium, and is converted almost entirely into carbonate of lime. I heard the evidence given by some of the managers as to the enormous quantity of lime they thought it necessary to use, and it appears to me most extravagant. Mr. Anderson tells me he uses a quantity of lime, which is altogether different from anything which I have heard stated here. The quantity he uses is equal to only 2-10ths of a bushel per ton of coals—that is, 2-10th of a bushel of slaked lime. It was stated by Mr. Evans, I think, that the usual practice is to take a bushel of lime to a ton, but I do not know whether that is a bushel of caustic lime or of slaked lime.

Mr. EVANS: Caustic lime.

Witness: That would be equal to two bushels of slaked lime; but, to continue that subject a little further, I may say that the quantity of lime used in gas-making, so far as I understand it, is out of all proportion to anything like the theory of the thing. Of course I do not mean for a moment to say that anything like theoretical perfection can be reached in these instances. In the first place, you have to deal with impure materials; in the next place, the processes themselves cannot be applied so perfectly as they might be to secure anything like theoretical results. But the theory of the thing is this: Take 100,000 cubic feet of gas, containing, say, 40 grains of sulphur to be reduced to 20 grains per 100 feet, that would necessitate the use of 30 lbs. of sulphide of calcium. Now, if you want to reduce 40 grains to 30, it would only be necessary to employ 15 lbs. of sulphide of calcium. The make of gas at Beckton is, I believe, about 15 million cubic feet per diem; to reduce 40 grains of sulphur in that gas to 20 grains would require about 450 lbs. of sulphide of calcium; to reduce 40 grains to 30 grains it would require only 225 lbs., and I am very much corroborated in that view by a publication of Mr. Mann, who is very well known as a gas engineer in London. He was for many years gas manager to the old City of London Gas Company, and ceased to hold that office when the companies were amalgamated. I knew nothing of his publication when these calculations were made; but I find that he agrees with me exactly in a letter published in the JOURNAL OF GAS LIGHTING of February, 1875. He there says that 11½ tons of sulphide of calcium would reduce the sulphur of 800 million cubic feet of gas from 32 to 10 grains, which works out to the same figures that I have here—that is, 30 lbs. to the million. I am not saying for a moment that I think any gas company could do it; but that is the result of the calculation. I said in my evidence on the Crystal Palace case that I thought the limit as to sulphur might be enlarged a little, but I think the Gas Referees are far better qualified to judge of the matter than anybody else outside the works, because they have statutory powers which enable them to go to the gas-works whenever they like. I have been in constant communication with them from the time of their appointment, and I am bound to say that they all appear to be most desirous of fulfilling their obligations both to the public and to the gas companies.

Sir E. BECKETT: Do you believe that anything, except the existence of some such body, with a control and power to vary, according to the requirements and according to the circumstances, can keep the requisite pressure upon the gas companies?

Witness: I think there is great advantage in having that elastic machinery to work with. If you fix a hard and fast line, there are no means of altering it, no matter what improvements take place. You are bound by that, and you must come to Parliament to get any change in it; but where a body like the Referees exist, they have the power to relax whenever they like.

There is a provision in the Act, independently of the Referees, that the gas shall not contain sulphuretted hydrogen at all; but is sulphuretted hydrogen in burning gas (I do not mean in leaking gas) any worse than sulphur in any other form?—No, I think not; it burns into the same compounds. If you burn sulphuretted hydrogen you get the same thing as you get if you burn bisulphide of carbon; there is merely the difference of its being a hydrogen compound instead of a carbon compound.

As a practical matter, do you believe after all that there is any real difficulty in keeping the quantity of sulphur below 30 grains?—In answer to that, it is constantly, and has been for years past, kept below that. I also think that lime can be treated in such a way as to do away with the nuisance during its removal. There are means of taking out the carbonic acid without the use of lime. Mr. Livesey pointed out that he had been using Hills's process of separating ammonia and the ammonical liquor from the carbonic acid and sulphur, and that he used the liquor so prepared for taking the carbonic acid out of the gas.

He stated also, I think, that the quantity of sulphur, apart from sulphuretted hydrogen, which is left in the gas before it is purified, is only 30 grains, or thereabouts?—Yes; but I think that is a great deal too low.

You mean, in fact, that there is a great deal more left in?—There is. I find in the sulphur reports of the Gas Referees in January, 1872—which is an account of a large number of experiments made at Beckton—that the quantity is very far in excess of what I state.

The experiments went on for some time, and there are weekly averages taken?—Here is Oct. 7 to 20, which is a fortnight, an average of 48 grains; Oct. 21 to Nov. 3, a mean of 46·4 grains for the first week, and 47·8 for the second; Nov. 4 to Nov. 10, a mean of 46 grains; Nov. 11 to Nov. 17, a mean of 43 grains; Nov. 18 to Nov. 24, a mean of 44·9; Nov. 25 to Dec. 1, a mean of 44·3, and then after that they are irregular.

How is the difference between 30 grains and 48, or whatever it may be that is actually left, to be dealt with? Supposing that 30 were placed as a minimum, would you have to use lime?—I know of nothing else but the use of lime. The figures I have read represent the state of the gas after the oxide of iron purification, as I understand; that leaves in the whole of the sulphur products other than sulphuretted hydrogen.

It seems impossible to get it down to anything like 30 grains without using lime?—That is the experience of the Gas Referees—or was.

Mr. MICHAEL (in cross-examination): Do you wish the committee to understand that it makes no difference to the consumer whether the gas supplied to him contains an equal quantity of sulphur in combination with hydrogen, as opposed to a similar quantity of sulphur in combination with carbon in various forms?

Witness: No, certainly not.

Whatever may be the theoretical non-difference between those two

chemical compounds when burnt, it does make a great difference whether or no sulphuretted hydrogen is taken out of the gas?—I should say it makes a great difference, and I think that the Legislature for years past has always made it a *sine quâ non* that the sulphuretted hydrogen should be take out.

Mr. MICHAEL: Do not think I am in any way at variance with you. I simply want your answer to be thoroughly explained in justice to the committee, to myself, and yourself. I did not think you wished the committee to understand that it made no difference whether it was in combination with carbon or hydrogen. May I direct your attention to the evidence you gave with respect to this very matter in 1874, upon Mr. Anderson's process:

Is it possible, as the result of that process, that there should be no sulphur in the gas and no sulphur in the lime, or in any portion of the lime, that is removed from the purifiers?—No; it is impossible.

Some of the spent lime, then, must be in a different condition from that which you analyzed?—Yes; as I understand Mr. Anderson's system, it is this: He uses a number of purifiers, and he works those purifiers in such order that the lime in some is always being converted into carbonate of lime, while it remains in a state of sulphide of calcium in others. As I understand, it comes to this: He begins with the series of four purifiers, and he passes the gas through No. 1 till the whole of No. 1—we will assume for the sake of argument—is converted into carbonate of lime.

That is for the purpose of getting rid of the carbonic acid out of the gas, which we all acknowledge is desirable for illuminating purposes.

He maintains a sufficient margin of lime in those purifiers to be enabled to take out not only the sulphuretted hydrogen which is proper to the gas itself, but also the sulphuretted hydrogen that has been expelled from No. 1 purifier, that must always be going on. When he has thrown out No. 1, to take out the carbonated lime, and replenished it, he must still have a margin to carry it on with. He must always have enough lime in the purifiers left, not only to purify the gas itself, but to purify the gas that has taken up an undue quantity of sulphuretted hydrogen from the purifier.

Supposing Mr. Anderson goes on purifying with lime for 12 months, and during the whole of that 12 months he does not remove any sulphur in his lime, where does the sulphur go to?—There must be an end of it at last, that is very clear, and at some time or other he must clear out his purifiers, sulphide or no sulphide.

Do you wish to add anything to that?

Witness: I may say that is very much altered by the explanation that Mr. Anderson gives, that he uses, after he has employed this lime purifier, oxide of iron, which gets over the whole difficulty.

Whatever may be the fact theoretically in the laboratory, is there not a great difference in carrying out the process practically on a large scale?—Of course; but if a maximum of 30 grains were allowed, you would be able to purify the gas with so much less lime, and then it would cease to be a nuisance. I think 30 grains is the extreme limit which ought to be allowed, and if there should be 5 or 10 grains above, it should be taken out.

May there not be at the present time (you told us Mr. Anderson's process is an improvement on something you heard in 1874), something which, in accordance with the evidence given before the committee, would reduce the average to 33 grains?—There is no single reason for such a thing. The gas in this case was purified by oxide of iron; the coals are a mixture of all sorts; and I see no reason why there should be any difference at the present time. I do not say there is no change, but there does not appear to me to be any reason to believe that to be the case. I consider the sulphur ought to be kept down to 30 grains, no matter what means are used.

The COMMITTEE: Do you speak of 30 grains as an average or as a minimum?

Witness: An average.

Therefore the difference between you and Mr. Michael is between an average of 30 grains and an average of 33?—I thought the committee suggested 35.

A maximum of either 35 or 40—either 35 over a week, or 40 over three days?—It appears from what I have read, from these elaborate series of experiments carried on for a long time, that the amount of sulphur in the gas exceeds 33 grains.

Do you think that in Paris and in London the sulphur compounds are different?—I only know from the evidence I have heard, but I think very little is known of that question in Paris. I think it is quite clear that the Paris gas is not so well purified as the London gas.

Mr. *Thomas Hawksley*, examined by Sir E. BECKETT.

I have been engaged in designing and looking after gas-works in England and on the Continent for between 40 and 50 years, and during a great part of that time I have turned my attention to sulphur. I have no recollection of ever having appeared in opposition to a company before; nor would I do it now if I thought that this was not a case that required the facts to be explained. I think the companies have generally been more sinned against than sinning; but this is the opposite case, and they seem to have gone boldly into sin now they have started.

At the request of Sir E. BECKETT, the CHAIRMAN repeated the suggestion made in the early part of the day—viz., that the maximum should be fixed for the present at 40 grains if the average was taken on three days, or 35 grains if taken for a week, and that it should be subject to variation only by a direct order from the Board of Trade, and also that the company should give every facility to the Board of Trade to make such experiments, under such conditions as the Board might desire, upon their works. There was likewise a further question to be considered, as to how the financial result or saving in that change of procedure should be received or enjoyed either by the public or the company.

Sir E. BECKETT: Having heard that, what do you say would be the effect upon the company?

Witness: The latter part of the suggestion is exceedingly valuable. How it would operate upon them and their dividends it is impossible for me to say, but with regard to the proposed limit of 40 grains I have to say——

The CHAIRMAN: That is the maximum?

Witness: Yes, but it is an average maximum. They may be at 50 grains one day, if they will come down to 35 on two other days, and that would amount to (if I may use such an expression), poisoning the consumers on two days out of the three in order that they might be relieved of 5 grains on the other one.

You mean that if the Acts, going as far back as the Act of 1860, had not been passed, they would probably have given us no more than 40 grains?—If there had been a thorough good purification in other respects, good washing, taking out the ammonia, and a previous washing with ammoniacal liquor for taking out such sulphur compounds as the alkaline and the ammoniacal liquor will take out, then there ought not at most to be more than 40 grains left after purification from sulphuretted hydrogen; so that, in fact, it is repealing the law entirely as it now stands.

The two practical issues we all see; and, first of all, the influences of, I will say, the difference between the 20 grains and the 40; and, secondly, the possibility of getting rid of this 20 without nuisance. First, as to the influences between 20 and 40, what have you to say about that?—Let me first explain, as it stood yesterday, with 35 grains, that would be the means of distributing into the houses of the consumers the equivalent (and it would be performed to a very large extent) of 2 million pounds of sulphuric acid per annum, and if it did not pass into sulphuric acid, and were only sulphurous acid, there would be more than a million and a half pounds so distributed through the town. I have seen the effects where gas has not been properly purified, and the effect would be, taking a mercer's shop, that the exposed edges of all silks in the upper part of the room would be bleached. Sulphurous acid has great bleaching power; it removes colouring matter, and has a great many other injurious effects. It affects the throat very sensibly, and communicates a nasty coppery taste in the mouth. I am a gas-maker in many parts of the kingdom, and I do not want to exaggerate the effect, but I regard this as a very retrogressive movement.

Sir E. BECKETT: Now, although 2 million pounds of sulphur are not to be sent into one house in the year, would that be enough to make a very sensible effect over all the houses?

Witness: Very sensible. I do not mean to say that if in a great room like this you had a good ventilating-pipe out of the corner, as I have in my dining-room, that you would suffer very much from it; but taking all the ordinary cases of habitations and shops, and workshops particularly, the mischief would be very considerable.

That is one part of the story; the other part is the nuisance question. What do you say as to the possibility of reducing the sulphur to 20 grains without any nuisance?—There ought to be no nuisance by reason of reducing it to 20 grains. A gas-work is not an agreeable neighbour, but the smells which come from thence are not in general created by the sulphur, if the process be properly conducted. Of course you may make a great nuisance by an improper way of purifying the gas, or of treating the lime after it has become refuse. At Nottingham we can, without any difficulty, keep the sulphur, other than sulphuretted hydrogen, down to 15 grains. I have also had to do with Derby, Sunderland, and other large towns, in great numbers, where lime is used, either by itself or in conjunction with oxide of iron. Where lime is not properly used, it can be made a nuisance, and many gas companies do make an unnecessary nuisance—I am bound to admit that—but by properly conducting their operations, both in gas-making and in dealing with the waste lime, there need be no nuisance whatever. The process of gas-making in London, as it is generally known, is a very bad one. It is very imperfect, and might be very much improved; but, in point of fact, in some places they try to do too much in a very limited area, and out of that particular circumstance arises a great deal of the trouble which the gas companies get into.

I suppose they will say that they cannot help their area being limited?—Yes, they can; at least, this particular company can. They have got very large means, and need not be making the great quantity they are doing at Fulham; or at the little place which used to be the Equitable works; neither need they be pressing other stations to the extent they do. I remember the time when Mr. Cardwell's committee suggested amalgamation, which was with a view to getting rid of the manufacture of gas in the thick of London; and it has had that effect. For instance, the City Gas-Works are discontinued as a place of manufacture.

It has been suggested that the men suffer from removing the lime, and so on; have you found that to be the case in other gas-works which are properly managed?—The men do not suffer from the removal of the lime; they suffer rather more from preparing the lime than from removing it.

With reference to the preparing, is that necessarily an unhealthy process?—It need not be, because it may be done mechanically if they choose to do so; therefore, of course, it would not be injurious.

The only remaining point is with reference to the powers of the Board of Trade to vary this maximum from time to time, and that has to be contrasted with the power of the Referees. Do you see how the Board of Trade can act in this matter except through some officers, whatever those officers may be called?—I have the pleasure of knowing all the Referees, and I know they are very competent people; they are scientific men, and they know enough of the practice of gas-making to guide their science, so as not to make mistakes; and I also know that the limits which they have prescribed from time to time are fair, and such as the companies, if they would only make their gas by a proper process, could fairly and reasonably adopt and comply with.

Supposing the Referees were abolished by name, can you see any way by which the Board of Trade could act, except by having some similar officers, but who would be called something else?—No; there must, I suppose, be some control, although the Bill seeks to get rid of all control, not only with respect to sulphur, but with respect to all impurities whatever.

As the Referees exist, and assuming them, for the sake of argument only, to be competent, supposing they came to the conclusion that it would be impossible to do this work without a nuisance, can you see any reason why they should not relax their conditions?—No: the Referees can tomorrow, if any reason is shown why it should be so, make their limit 25, 30, 35, 40, or 50 grains. They can make it anything they like; but if it is done by Act of Parliament it is done rigidly, and without any regard to what might be an improvement in gas manufacture.

But that is not the committee's proposal. The present proposal is, that the Board of Trade should have the power of reducing the 33 or the 40 grains, whatever we call it, below that amount whenever they think fit. I ask you if there is any advantage in that over the Referee system?—No; it amounts to the same thing, I should say, in the end. It is 33 grains, as I understand, with a power of diminution.

Whereas it is now 20, with a power of raising it?—Yes, and it is raised; it is 25 in winter.

So that the introduction of anything like the recognition of 33 or 40 grains would be very nearly doubling the maximum which they have been allowed for the last 17 years?—Not doubling, but adding two-thirds to it.

Examination continued: I have burnt the Chartered Company's gas for nearly 30 years, and am satisfied with it; it is not very rich in illuminating power, but it is a very pure gas—reasonably pure. Some time ago I had cause to complain, because my office, which consists of several large rooms, was perfectly unbearable, and that was within half an hour after the gas was lighted. I applied to the company, and they sent one of their people, who looked round my room—not knowing who I was, or what I knew about gas—and he said, "Oh, it is your burners." That is the staple answer or suggestion of remedy; but my burners had been there long before, and are there still. The company paid no attention, and so I wrote a letter to the Gas Referees, and they took some steps (what they were I do not know), but after a short time the gas became quite pure, and I have had no cause of complaint since.

By the COMMITTEE: I should think that took place three or four years ago; but I can show you something which is very interesting. This [producing a bottle of water] was taken out of one of my gas-pipes, not experimentally at all, but was the result of less than two hours burning of three gaslights in my drawing office. A chemist will follow me who will tell you what are the contents of this water in sulphur, and also tell you how acid it is, and that it destroys the iron of the pipes. He will show you the iron in it.

Sir E. BECKETT: Before the chemist comes, will you just explain how that water was actually obtained?

Witness: I have in one of my offices three gaslights over a drawing-table, and those communicate by a ventilating tube with a horizontal pipe which carries the products of combustion into the chimney; that pipe is cold, and condenses the products of combustion into water, or rather

into this liquor which I have here. That is drawn off by a decending pipe into a vessel, and out of that vessel it was poured into this bottle, and this was the result of less than two hours burning of three Argands.

It is the distillation of the gas vapour?—In the ordinary course, and I can bring you pints of it from my office, in which every light is ventilated; and from the pipe which conveys off the products of combustion I can get this liquid in quarts at any time. It is not, of course, the amount of liquid, because the consumption of gas results in the formation of water, but it is what the contents of it are. You will find plenty of acid in this if you have a bit of litmus paper.

By the COMMITTEE: I have a bell over each light, and they go into one tube, which tube communicates with the chimney. About 5 cubic feet of gas is consumed by each burner, making 30 feet. [The litmus paper was produced, discoloured.] Now they say that there is no sulphuric acid generated. Just look at that.

Sir E. BECKETT: I hear it stated that sulphurous acid will do the same?

Witness: Sulphurous acid dissolved in water will, but I have no doubt this is sulphuric acid. At all events, you see the effect of it; it does not matter what it is, whether it is called an acid or not.

Examination continued: Purifying gas properly ought not to cost more than a penny per 1000 feet above what it costs to purify it improperly. I have some knowledge of the Paris gas, which was spoken of yesterday. I know there they manufacture their gas by a very much better process than the one which is adopted in London. They work with four-hour charges, whereas in London they work with six-hour charges, and the result is that they produce in London more of this obnoxious compound than would be produced by a more rapid distillation of the coal, and not draining it to the dregs, as they do in London. I believe the bisulphide of carbon is produced in this way:—There is, especially at the latter part of the charge, a good deal of carbonic acid, and also carbonic oxide, and there is likewise sulphuretted hydrogen coming off from the coke, which contains a good deal of ferruginous matter with which the sulphur is commonly combined. Now the way in which it happens, I believe, is this—that two molecules of sulphuretted hydrogen are combined with one molecule of carbonic oxide, or it may be carbonic acid, the result of which is the formation of bisulphide of carbon, which is a very obnoxious matter; and if it be with carbonic acid, then one equivalent of oxygen is set free, and that may account for the small quantity of free oxygen which is always found in coal gas, and which has been a difficulty, as far as the theory goes, hitherto. If they work off the charge, as I do in a shorter period in these provincial works, and particularly if they worked it off in the manner which is adopted in Paris, I have no doubt they would have less of this obnoxious compound. The next thing to do is to wash the gas well with ammoniacal liquor, and that absorbs an enormous quantity of bisulphide of carbon—so much that the ammoniacal liquor stinks abominably. Then there is less to go forward to the next process of purification, which ought to be passing the gas through oxide, to take out all the sulphuretted hydrogen. There ought next to be lime, for the purpose of taking out the carbonic acid, because the two can be taken out together, and I do it constantly, notwithstanding all that has been said to the contrary. Then the gas goes on to what is called the catch purifier, filled with oxide of iron; and if any sulphuretted hydrogen passes over, it is caught in that vessel. The process is very simple, very economical, and very sure in its results; and the lime, instead of coming out in the obnoxious state in which it ordinarily does from the purifier, comes out very nearly white, without a very obnoxious smell, and is only coloured by sulphur in a pyrophoric state diffused through it.

Sir E. BECKETT: To sum up, do you think that, on the balance of convenience and inconvenience, between leaving an extra 20 grains of sulphur in the gas and running the risk of the nuisance of purifying it, the balance on the part of the public is in favour of having their gas kept pure?

Witness: Undoubtedly.

Cross-examined by Mr. RICHARDS: It is not a question of conduct on the part of the gas company, because they are obliged to be good boys at the present time; but they come here for leave to be able to behave as they please. I consider that the company are doing too much work upon particular areas of land, and that their apparatus is not well adapted to the requirements which Parliament has imposed upon them. The company are doing too much at Fulham, and also at Pimlico.

Mr. RICHARDS: Do you know what they are doing at Fulham, and that for the last year a large portion of the Fulham district has been handed over to Beckton?

Witness: No, I cannot answer that. All I know is what they say they are doing.

By the CHAIRMAN: With regard to the alleged nuisance in the neighbourhood of Kensington, I may mention a fact within my own knowledge. I happen to live in that district myself, and the great nuisance there is not from the gas-works, but from a brick-kiln, which many persons take for a gas nuisance.

Cross-examination resumed: We had a complaint exactly similar to that of Mr. Veitch, made at one of the Nottingham works, some years ago, by a florist; and what the company did was to set up a flower-garden in the works, and the flowers grew so beautifully that they never had a complaint afterwards. I do not wish to suggest that the engineers of the company have not done their best to prevent a nuisance, but, from what I have heard in this room, the process which they adopt for the purification of gas is well calculated to make a nuisance. They are very intent on purifying the gas by sulphide of calcium, and, as I understand, use the foul lime for the purpose of taking out the bisulphide of carbon; and if that is done, it will to a certainty make a nuisance, for the gas lime is a most offensive thing. It need not be done in that way, because there is no occasion to bring the sulphuretted hydrogen at all in contact with the lime. The lime, as I have mentioned, will take out the bisulphide of carbon when it is in a pure state, and it does not require to be made impure for that purpose. One ton of lime will purify the gas of 40 tons of coal, both from carbonic acid and bisulphide of carbon, and that after you have taken out the whole of the sulphuretted hydrogen. That is what I did at Nottingham.

Mr. RICHARDS: What is it that makes such an abominable stench at Nottingham at the present moment?

Witness: Nothing. No gas-work is free from smell; the oleaginous and ammoniacal matters which are produced in the distillation of coal always produce a smell, but that is a very different thing from the smell of the foul lime.

I understand you to admit that the sulphur compounds must be got out in order to meet the requirements of the Referees, and that necessitates the use of lime to get them out?—Yes; but the use and removal of the lime may be so managed as not to produce an obnoxious nuisance.

You also think there should be shorter charges—that is to say, that the retorts should be filled at more frequent intervals?—I do not say that is a *sine quâ non*. I am merely telling you how the Paris people conduct their works, and how it is in the country works of mine. I can also tell you that in Scotland (but they use a different coal there) they work with three-hour charges.

The CHAIRMAN: What, in your opinion, is the degree of purity from sulphur compounds—exclusively, of course, of sulphuretted hydrogen—which can be attained by the peroxide process, without recourse to the lime process?

Witness: That would vary according to the quality of the coals. Many coals contains as much or more than half a hundredweight of pure sulphur in a ton; the Midland coals do.

But the kind of coals which are used in these large works?—They use all kinds, and there is a difficulty in answering the question without an explanation. The best gas coals do not contain more than 40 lbs., and, therefore, the question is not so easily answered; but I should think, taking the Midland coals, that there are quite 50 grains of this bisulphide compound in 100 cubic feet. Taking the north country coal, I do not believe that there are more than 35 or 40; but it is a question very difficult to answer, because in the crude gas, as it reaches the purifier, or, rather, the commencement of the process of purification, the sulphur very often amounts to 250 grains.

What I want to know is this: Supposing a limit is fixed for this City company—we will say an average of 35 grains—will they be able to attain that degree of purity without having to resort to the lime process?—I should think not.

What degree of purity do you think they could obtain?—It would rather restrict them as to the purchase of their coals, which will be a very undesirable thing; but I should think that they could find coals which would bring the quantity down to about 40 grains.

Do you mean an average of 40 grains?—Yes; but I do not know exactly what is meant by average, because that is a very uncertain thing. You might have a very impure gas one day, and a very pure one the next.

Mr. Keates said he thought the companies might be allowed safely and properly to go to an average of 30 or 33 grains of the sulphurous compounds in the manufacture of their gas; do you agree to that?—No; I think you would perceive the effect of that in a close room. I think the 25 grains fixed by the Referees is as low as it would be prudent to allow. If that amount is right for winter, I do not see why it is not right for summer; that is the difficulty, I see, in the Referees instructions.

You seem to me to have a very strong objection to this principle of average, but suppose the average was 35 grains, would you then say that, for the sake of a relief of five grains on one day out of three, people are to be poisoned for the other two days—that is to say, by an increase of two and a half grains?—No. I have been very much misunderstood, or have very inaccurately explained myself, if I have been misunderstood to say that.

You terrified us when you began, because I took down your words that "people were to be poisoned on two days in order to give a relief of five grains on the other one"?—No; what I say is this—that if you have 35 grains on two days and 50 on another day, it does not at all relieve the people.

The CHAIRMAN: What I understood you to say distinctly was, that the public would be poisoned for two days in order to give them a relief of 5 grains on one day, and that is a very serious thing.

Sir E. BECKETT: "Poisoning" is, of course, a metaphorical expression.

The CHAIRMAN: If it went forth to the public without some qualification it might produce a very injurious effect.

Witness: I was not in earnest in using those words, and, with very great deference to yourself, I do not think I used the words "being poisoned on two days," but I think I may have used the expression, "being poisoned one day out of three," because you may have a very large quantity of sulphur on one day, and from that the public would suffer, while that quantity might be corrected down to the average by the two other days showing a very low quantity comparatively.

The CHAIRMAN: You may have intended to say that, but you stated exactly as I tell you now. With regard to another of your answers, you spoke of distributing 2,000,000 lbs. of sulphuric acid; you do not say exactly where, but I suppose if that were extended over the three kingdoms it would not do much harm; and, therefore, it depends entirely upon what area it is to be extended over?

Witness: It is a practical question—Can you perceive it by the nose, and does it produce injurious effects on delicate goods? I answer in both cases in the affirmative from experience.

By the COMMITTEE: When I used the word "poisoned," I did not mean poisoned to death—that is quite a different thing—but what I meant was, poisoned in the sense of the quantity of sulphur being then very obnoxious, and in amount sufficient to do injury both to health and goods upon that one day out of the three. Supposing myself to be in the position of President of the Board of Trade, and that the committee had stated their conviction that 40 grains was the proper limit, I should be very careful indeed about taking any steps to impose a lower standard of quality upon the companies.

The COMMITTEE: In one of the letters which has been put in, from the Referees to the Board of Trade, they admit that there is much to be said in favour of the view that the presence in gas of sulphur, which the lime process removes, is of no great consequence to the consumer?

Witness: That depends entirely upon the state of the consumer's ventilation. If the consumer will make perfect ventilation in his house, which very few consumers will make, then it is not of much consequence; but under the ordinary condition of houses, I have no hesitation in saying that it is of considerable consequence, and in workshops particularly.

The COMMITTEE: The proposition referred to is as follows:—"While admitting that there is much to be said in favour of the view that the presence in gas of the small amount of sulphur which the lime purification removes is of no great consequence to the consumer, we are still of opinion that it would be a measure of questionable expediency to relieve the companies altogether from the obligation to make and supply gas as pure as can reasonably be required, because the main inducement to invention and effort in this direction would thus be removed."

Witness: What the "because" means I do not know, but stopping at the word "required," I agree with the sentence.

The COMMITTEE: Do you agree with the admission that there is much to be said in favour of the view that the presence of this small additional quantity of sulphur is of no great consequence?

Witness: Yes; but there is very much to be said on the other side.

Mr. *Charles Heisch*, examined by Sir E. BECKETT.

I examined the water which came out of Mr. Hawksley's gas chimney, but I have not had time to make a quantitative analysis of it. I precipitated half an ounce of it with chloride of barium, to which I added a considerable amount of hydrochloric acid, to make sure that nothing but sulphate of barium was precipitated. I have here a bottle which will show the amount of iron which is taken up from the pipe [producing a bottle]. This is the iron in solution, which was precipitated by ammonia, and it will give an idea of the amount of the corrosion going on in the interior of the pipe.

By the COMMITTEE: I cannot say how long that pipe has been in use.

The COMMITTEE: If it goes on at that rate every two hours, it will not last very long?

Witness: That is what is in solution in this particular quantity of water. Of course, the whole corrosion of the pipe would represent a good deal more than that; but I can mention, as a matter of experience—because I

have tried it—that if I start with a perfectly new pipe, I find that about one-half of the sulphur existing in the gas burnt is condensed in the pipe in the form of a sulphide of the metal of which the pipe is made, provided it is a metal on which sulphuric acid acts.

Examination resumed: I have heard of the proposal to substitute the Board of Trade, acting through somebody, for the Referees; but I do not think it would make any difference, except that it would give them a starting position, which the Referees have not. I should not like to go to the gas-works for the purpose of making experiments, because it would require a combination of elements which I do not possess in my own person. To make those experiments properly a man ought to be a mixture of a chemist and a gas engineer.

Sir E. BECKETT: Take this hypothesis. If we suppose the company themselves undertake to make the experiments, would you like to be bound by the results, supposing you were a Referee?

Witness: I do not think I should. It would depend so much upon circumstances what the experiments were. The carrying out of experiments in that way is a thing which it is difficult to do without interfering with the works to a certain extent. If it were merely trying certain modifications of processes in use, that is one thing; but if it is trying an absolutely new thing, it is another.

Mr. MICHAEL (in cross-examination): Putting yourself in the position of a chemist, and assuming that you had devised in the laboratory some mode which you had proved in the laboratory to be successful, you would not consider that successful until you had an opportunity of trying it on a large scale?

Witness: No.

What could you wish for better, if you have confidence in your experiment, than to have it tried upon a large scale at the gas-works, where practically you could test the system which you had elaborated in your laboratory?—I think that would depend a good deal upon the amount of assistance which you could obtain in the engineering part of the business from the engineer of the company. If he were willing to take the thing up, and willing to help you over the engineering difficulty, and you to help him over the chemical ones, I would wish for nothing better.

All you want in the gas-works is the presence of gas in large quantities to be purified; that will be the first primary condition, of course?—That is the primary condition, of course.

What difficulty would there be in the Board of Trade sending their own engineer to put up the box which you had invented in the laboratory?—I should think there would not be any difficulty in that.

The COMMITTEE: There have been experiments conducted by the gas company, at the instance of the Board of Trade, at considerable expense. Were there any complaints of the way in which those experiments were conducted on the part of the Board of Trade at the gas-works?

Witness: I am not aware of that.

Whatever Mr. Vernon Harcourt has suggested has been tried?—I can give no evidence about that.

At the conclusion of Mr. Heisch's evidence the CHAIRMAN said the inclination of the committee was to give some such relief to the gas company as had already been suggested at an earlier period of the day. They were the more inclined to do so, as on the balance of convenience they thought the injury to that part of the public which suffered by the process of lime purification was on the whole greater than the inconvenience suffered by the public through a slight increase of the maximum of the sulphur compounds, other than sulphuretted hydrogen, permitted to remain in the gas. It was not, therefore, in any way to relieve the company from the bargains which they entered into when they obtained their Act last year, and it would be for those who represented the public to make any suggestion they thought fit, and support it by such evidence as they might require, as to whether any alteration should be made in the price at which gas was in future to be sold by the company. The committee would also like to know, as exactly as possible (because up to that time there had been some little difference of opinion on the subject), about what the minimum of sulphur impurity obtainable in gas, without using the foul lime process, would be. Besides that, the committee would have to take care that the clause (should they agree to vary the clause as it stood) should be drawn in such a way as to give the most ample opportunities to the Board of Trade to make all experiments they might think fit under the most favourable conditions.

Mr. CRIPPS expressed a wish to consult with Sir E. Beckett, and, after some conversation, the committee adjourned.

THURSDAY, MAY 17.

Mr. *Frederick Joseph Bramwell*, examined by Sir E. BECKETT.

I am an engineer, and have given evidence upon a great many gas inquiries. I have visited several gas-works, both at home and abroad. As regards the question of nuisance, I do not consider that the evidence which has been given by the Chartered Gas Company is at all conclusive, neither do I think that the best means have been adopted to prevent it. From my own knowledge, I am convinced that there are means of carrying on the reduction to 20 grains by means of lime, without imposing any nuisance on the neighbourhood.

Sir E. BECKETT: Evidence has been given of various conditions of things at the different works; for instance, at Pimlico, it sometimes appears there is a nuisance, and sometimes there is not a nuisance. What do you infer from that?

Witness: That at one time more care is taken than at another. I know the Pimlico works well, and I heard the evidence that was given about the nuisance created by taking the spent lime in a cart across the roadway, and shooting it into a barge. I know there is a subway along which the coals come, and through which the lime might have been taken; and it does not look to me as though that was a strong effort to get rid of the lime with the least nuisance possible. I have heard the evidence which has been given, and I agree with it as to the fact that no nuisance need necessarily be created.

Do you also agree that there is, in some cases, carelessness?—The instance that I cited just now appears to me to be carelessness.

On the question of getting rid of this lime; have most of the works railway communication or canal communication?—Yes; almost all the important works now have either railway or water communication.

Take the case of the railway, would it be easy to get the lime on to the railway without exposing it, and so creating a nuisance?—It appears to me to be so, in the following way:—Instead of putting the purifier in the open air, place it on the first floor of the building, and deliver the lime through the bottom of the purifier instead of shovelling it over the top; it could then be delivered straight down through the shoot from the bottom of the purifier into the very receptacle that you have to take it away.

That is assuming the lime is in the state in which Mr. Anderson tells us it need not be?—It is assuming the lime is in an offensive state, but I am not chemist enough to say whether it need be in such an offensive state. Some years ago I had occasion to study this matter, in connexion with one of the most offensive trades I know of—viz., bone-boiling, in which odours were emitted worse than those coupled with the notion of putrescence; and in that trade, by the precaution of carrying it on within a building, and having an exhaust fan to make an in-draught of air, there was no nuisance whatever outside the building.

Inasmuch as the company have now Beckton and other places out of London, they need not necessarily carry on so much work at Fulham, St. Pancras, and other places in London?—As regards Beckton, except the outfall of the Metropolitan Board of Works sewers, I do not know what neighbourhood there is to be offended. They have no neighbours to complain there—their nearest neighbour is the outfall.

You mentioned having seen several gas-works abroad; can you tell us anything about the mode in which purification is carried on?—No, except seeing the children going about to be cured of whooping-cough. At Brussels the purifiers are made with an internal framework, so that the whole of the contents are lifted out bodily, and taken away and revivified, instead of being shovelled out.

A suggestion has been made to the committee that experiments should be carried on by some new Referee or officer, or whatever he is to be called, on the gas-works themselves, by the gas people. How do you think that would work?—If the Referees have practical knowledge, they do not want the aid of the gas company; but if they want the aid of the gas company to get practical knowledge, it is asking the company to make a rod for their own backs.

And show the Referees how to flog?—Yes. That is to say, if the experiments are successful, it is to impose upon them the continuance of the purification from these other sulphur compounds; whereas, if they are unsuccessful, the suggestion is that they are to be relieved.

Would you yourself like to be a Referee, and have these experiments carried on by those whom you have to control?—I should feel that my office was really a nominal one.

Cross-examined by Mr. POPE: I have given attention to the purification of gas for the last five years. I am not a chemist, but I suppose I know as much about purification as any other gas engineer who is not a chemist. I know that at Brussels there is a purifier of lime in connexion with the oxide.

Mr. POPE: So there is everywhere; but on the question of the possibility of conducting the purification by lime without a nuisance, you are vouching continental works, and I want your knowledge on the subject.

Witness: I can only tell you of the one at Brussels, and that I have not seen; but the question put to me was not as to purification by lime; it was a question as to what I had seen. I have not seen the process of removing the spent lime at the Pimlico works, but I heard Mr. Dines's evidence, and I know those works, and also the subway, as I had particular occasion to inquire into it some years ago. That subway communicates with the river side, and if a cart containing spent lime were taken there it must necessarily shoot its contents into the barge lying upon the river brink.

Which is the precise material which Professor Tyndall said caused the nuisance?—So I understood. Will you let me state that my impression was that the lime was taken in a cart across the public roadway, on a high level, and from there shot into the barge; and I say that that was a way that was much more likely to cause a nuisance than if it had been conveyed in a truck along the subway under the road, and turned into the barge from a less height.

Do you suppose that any of the nuisance arises while it is crossing the road?—Certainly.

In what condition is it taken across?—In a cart, covered with a little earth probably, but I do not know whether it was or not.

If it is covered with breeze, it is perfectly inodorous, and there would be no nuisance created?—If it is inodorous, of course there is no nuisance.

Do you believe that it was shot uncovered into the barge?—No; I believe it was covered.

Then the whole difference would be that taking it along the subway would make the shoot less high, in fact?—Yes; but I may make a remark upon that. Either the operation is so conducted that there is no nuisance at all—and I thought that the suggestion was that there was a nuisance—or it is so conducted as that it might be improved, as regards the descent through the shoot.

The improvement possible is a reduction of the height of the shoot?—Yes.

That is the whole of it, though you have not seen or investigated for yourself how far the nuisance arises in that way or otherwise?—I do not know whether you put to me that there is a nuisance or that there is not. If there is not, I suppose there is an end of the case; but if there is, then I think it could be reduced.

How about the rise and fall of the tide? That would increase or diminish the height of the shoot, would it not?—The road being above the subway, it is quite clear the height, whatever it is, is *plus* this fall.

I do not quite understand your analogy between sulphuretted hydrogen and bone-boiling?—I think the analogy, I will not say is obvious, but is pretty smellable—two bad stinks.

Do you yourself make no distinction between vapour given off by bone-boiling, which contains an organic stink in it, so to speak, and sulphuretted hydrogen, which is gaseous and diffusible?—I have no doubt I could demonstrate between one smell and the other.

Do you mean to say that the physical conditions of the two are altogether analogous?—I do. For the purpose of preventing the diffusion of the smell, it does not matter very much whether it is sulphuretted hydrogen or Eau de Cologne.

What is it that causes the nuisance of bone-boiling, which runs over in vapour?—I am not chemist enough to tell you. I can tell you it is a dreadful stink, but I cannot give it you chemically.

You cannot say whether it is gas or organic matter which comes over in steam?—I tell you it is partly uncondensable, I believe.

Cross-examination continued: What I suggest is that a purifier might be placed on the first floor, railway-trucks run underneath, and the lime shot from the bottom into those trucks, or else into a barge, by which means it would be quickly got rid of.

Quickly getting rid of the stuff—that is to say, taking the bottom out of the purifier?—Not taking the bottom out, but shovelling it through openings in the bottom, as is done, and as is thoroughly well known.

The COMMITTEE: Done where?

Witness: At the Commercial Gas-Works.

Mr. POPE: That is an awkard illustration, for that is the place where the maximum is raised by the Referees to 30 grains?

Witness: Yes, and where the works themselves are making at the present time, I believe, only 13 grains. I do not think there is any smell from the Commercial Works at the present time.

Then there is no necessity for what the Referees have done, in your judgment?—I believe the cause to be that at the time the Referees made that order the plant of the Commercial Company was not complete.

All you suggest is, care in the administration of this lime process?—Yes.

And you also express decidedly the opinion that lime purification does not necessarily create a nuisance, however small?—I do; that is to say, no greater nuisance than arises from the conduct of other processes of gas-works. I have likewise seen the process of lime purification carried on at Beckton without a nuisance. Supposing Beckton were in the middle

of London, the whole works would be a nuisance, but I do not believe the lime process need be. As I understand the Act, the function of the Referees in lime purification is limited by whether the process can be conducted so as to be a nuisance or not. If, therefore, it be a nuisance, the companies are relieved from the expense of lime purification. My evidence is based upon the assumption that the best efforts are made to prevent its being a nuisance.

Re-examined by Sir E. BECKETT: The Commercial Company were one of those that accepted Mr. Forster's legislation of 1875, and whether the Referees have prescribed or not prescribed, I know as a fact that they are making gas with only 13 grains of sulphur left in without a trace of nuisance. My last visit to their works was about a month or six weeks ago.

Sir E. BECKETT: My learned friend seems to have got some notion that there are diffusible and indiffusible smells; I have not met with the indiffusible ones, have you?

Witness: I have no notion of a smell which is capable of being laid hold of, which appears to me to be a smell which is not diffusible. I do not like to refer the committee to the lines in Pope about what will perfume a spacious drawing-room and does not weigh half a grain.

You were asked about your experience abroad, and so on; I suppose you need not go abroad to find out that purification can be done without smell when you see it done in England?—To my mind, if you get it done on a large scale in one works, that establishes the fact; just as if you had seen a locomotive running once, that would be establishing the fact that there was such a thing as a locomotive, although every coach builder and coach driver in England swore that it could not answer.

Do you know how long it is since the Commercial Company finished their plant? As I understand, it is a plant for an improved process of purification by lime?—The completion of the plant, I believe, has not yet taken place for their winter make. It was in progress when I was there, but not completed. The plant for the summer make was completed.

Did you see the process of opening the lime purifiers and cleansing them whilst you were there?—It had finished the moment before I got there.

How do you know that it finished the moment before you got there?—I was told so by the foreman. I went on board the barge, which was lying there with the stuff put into it, but I think there was a tarpaulin over it. When I took hold of the lime and lifted it, it had an offensive smell.

Until the cover was removed you perceived no serious smell?—No, but I may describe it to you very briefly. There is a house containing four lime purifiers of large size—I think 36 feet by 28 feet—upon the first floor. That house abuts upon the canal, and the material is emptied down through the bottom of the purifier into the bottom floor, and is then carried away into the barge which lies immediately outside the house.

As a matter of fact, when you say it had been a moment before, I suppose it might have been half an hour or a quarter of an hour?—It was this: "I believe we are emptying now." I go into the house: "We have just finished."

If it had been a quarter of an hour before, whatever smell there was created in opening the purifier was all over, and probably would have been removed?—I should think not, because this is in a closed building. I should tell you that the purifier was open, and the contents had to be delivered, and were at that moment on board the barge, and some were lying about. I hope you do not fancy that I am saying that there was no offensive smell within the house, but what I am saying is that it did not spread outside the house.

If any smell had escaped from the house a quarter of an hour before you went there, it would not be likely to be hanging in the air still?—No; if it had escaped a quarter of an hour before, probably not.

I have not quite caught from you the process by which you believe the nuisance, which might otherwise have been created, is avoided at the Commercial works?—The purifiers are in a close building, with only the ordinary openings, and instead of the stuff being pitched over the side of the purifiers, so as, it appears to me, to perfume the air as much as possible, it is sent through the bottom of the purifiers through four openings.

Are there layers or trays, may I ask you?—Yes.

You have not seen them working the process of getting rid of this stuff, therefore you cannot tell us in what way they clean out the lime between the trays?—The trays are lifted. When the first row of trays is cleared, that is lifted, and the next cleared, as in any other purifier.

Do you think that that is an experiment which, supposing it were successful at the Commercial works, it would be possible to have tried at the other works, under the superintendence or by the order of the Board of Trade?—I do not think it would be possible. If it is to be a Board of Trade experiment, it will be said that it is not a practical one; and if the Board of Trade, to get rid of that objection, are to put themselves in the hands of what are called practical men, I am sorry to say I think you are asking practical men to——

Surely, as I understand you, the experiment is not only a practical one, but one which has been carried into effect in other works. Then, what difficulty can there be, if competent men are employed for the purpose, to have that process entirely imitated?—As I understand, the Gas Referees, being gentlemen of knowledge and skill, say, "It is not for us to give directions as to what is to be done; but we do know, as a matter of fact, that it can be done, and therefore we go on with our orders."

Do you believe that that decision of the Referees is founded upon the success of the Commercial Company's experiment?—I will not say upon that, but upon consideration of what really can be done. I do not call it an experiment at the Commercial Gas Company; it is a question of construction.

Re-examination continued: I have visited the Beckton works on three occasions, the last being in 1876, but I cannot say that I have been there when the purifiers were opened and cleared. All I can say is, that when I was there I observed no serious nuisance, but that is quite consistent with the fact that when the purifiers were opened and cleared there might be a considerable nuisance.

Sir E. BECKETT: Do you know enough of those Brussels works to say whether the process of lime purification there is for the same purpose as is conducted, we will say, at the Fulham works?

Witness: I do not know. But whatever the material might be that was in the purifier, it was possible to empty it out without shovelling it, by taking it out *en masse*.

The mechanical difficulty would depend very much upon the size of the purifiers and the work that they had to do?—Upon that I would say "Yes;" but at the present day we have so improved in our power of lifting weights that I know of no difficulty that could occur.

Is it your opinion that at Beckton, or at Pimlico, or at Fulham, there is no mechanical difficulty in applying such a process as you have described to us as being adopted at Brussels?—I do not believe there is any.

Would it be a very great additional expense?—If you were making the plant new I should say it would be trifling, but if you were to adopt the old plant I should think it might be a considerable cost, but it would be wrong for me to give you any suggestion upon that.

Do you think that, supposing the company were willing to go to the expense of obtaining more space, we will say at Fulham or Pimlico, that they could thereby adopt the improved process that you have spoken of, and in that way mitigate the nuisance?—It appears to me that if the process can be conducted upon their present ground in a manner which is said to cause a nuisance, that it could be conducted on their present ground in a manner that would not cause a nuisance; but following that, I do not see how the mere increase of ground, without improving the manner that might be adopted on the present ground, would prevent the nuisance.

Re-examination continued: As to the saving of expense to the gas company, supposing that they were not required to use the lime process, that is a matter upon which I would rather not offer any opinion at present. I consider that the evidence of the promoters is not conclusive, because they attempt to negative the proposition that purification can be done without a nuisance, while I believe it can be.

Sir E. BECKETT: How is this matter of taking out the trays managed at the Commercial works?

Witness: You change the top tray first, then take it out, and then empty the next tray.

Do you shovel it over the top of the purifier?—You shovel it down the shoots; it comes through at the bottom.

Mr. POPE: You must take the top off before you can get to the top tray?

Witness: Yes.

What is the difference between them—one goes over the side, and the other down a hole in the middle?—If it does not commend itself to your mind as being a difference, it does to mine. One thing is, that the purifiers are under cover; and the other is, that, being under cover, the stuff is shot down through openings in the purifiers.

By the COMMITTEE: If a man is in one of the purifiers, he has the stuff to shovel out into a sort of watch-box, and there is far more probability of the air being impregnated with odour than if it is simply turned down alongside the shoot which stands up through the bottom. There are four shoots which stand up through the large purifier, and which go direct into the floor below.

The COMMITTEE: Have you any knowledge as to the balance of discomfort or the balance of injury resulting from the difference between 20 and 40 grains of sulphur?

Witness: Not to give it you in quantity. I have, however, this knowledge, that occasionally the gas in my house is extremely unpleasant when tasted; at other times it is better, and you do not taste that unpleasant flavour; the difference being, as I presume—in fact, as I know from tasting—the difference of sulphur; but how many grains of it are present I cannot tell. My supply is from the Wandsworth Gas Company, but I do not think they are under the Referees. I do not know their maximum, but I may tell you that I will not use gas, on any account, in my sitting-room.

The CHAIRMAN (addressing Sir E. Beckett) said he thought the evidence just given was the most important on behalf of the opponents they had hitherto heard. Mr. Bramwell had formed his opinion and given his evidence very clearly; but he had only formed that opinion from a visit. According to his evidence, the Commercial Gas Company had lately adopted improvements which had practically got rid of the nuisance; but that evidence had not been given by a witness who was present when the most difficult part of the process was being performed, namely, that of opening and cleansing the purifiers; and, therefore, some further evidence ought to be given upon that subject.

Sir E. BECKETT said he had no control over the Commercial Company. How on earth was it likely that he should get witnesses from one gas company in London against another gas company in London. Of course, if the present Bill was passed, they would all come for a relaxation. If the committee thought proper to send for the engineer, it was quite open for them to do so.

The CHAIRMAN: I think it would be as well. It is quite plain that we cannot finish to-day, and, therefore, supposing you failed in changing us from the opinion we mentioned yesterday, and which you understand was entirely a suggestion, it will then be necessary to go into the financial question, which no doubt will be a difficult matter. It would not be possible to conclude the case to-day entirely, under those circumstances.

After some conversation, and the committee having deliberated,

The CHAIRMAN said it was not only the evidence of the gas engineer, but the learned counsel would probably be able to call some of the residents in the neighbourhood of the Commercial Gas Works, and they could not be supposed to be hostile to the case of the opponents at all, but it was rather throwing too much upon the committee to require them to find out evidence for themselves in support of that view. The question was one entirely of a balance of convenience between that part of the public who as consumers might be supposed to suffer from the greater amount of sulphur present in the gas, supposing the limit were now relaxed at all, while on the other hand there was the injury to that portion of the public who lived in the neighbourhood of the gas-works where the lime process of purification took place. Of course a great deal in the decision or in the estimate of the balance of convenience must turn upon whether it was possible, by greater care and attention, to diminish or entirely remove the nuisance created by the lime purifying process. The case made by the promoters was that there was not in existence at present, or known, any means of using lime for the purpose of purifying those various compounds out of gas which could successfully be adopted, but the committee had just heard of a process or a practice in using the lime purification which produced a great degree of purity, and at the same time was innocuous. That was an exceedingly important circumstance, especially as the experiment was conducted under all the conditions under which it would have to be carried out, if adopted by the gas company at present before the committee. He (the chairman) thought Sir E. Beckett would see that it would be very satisfactory, before they arrived at a final decision, to have that case as fully explained, and as completely before the committee, as possible, both as regarded the process which was adopted by the Commercial Gas Company, and also as regarded the effect upon the neighbourhood—as to whether, in fact, when the purifiers were opened there was that nuisance created.

TUESDAY, JUNE 5.

Sir E. BECKETT said the committee would recollect that he had stated he did not expect that he should find Mr. Jones a very willing witness against his brethren of the London gas companies; that guess had been verified, and certainly he should not take the responsibility of calling him, although it was open to the committee to call him if they thought proper. There was one thing, however, which had been done. In consequence of the Paris evidence, two or three gentlemen had been sent over to Paris to analyze the gas there, and they would give the result of that analysis.

Mr. *Charles Heisch* recalled, and examined by Sir E. BECKETT.

During the holidays I have been over to Paris with Mr. Wigner and Mr. Shuter. We visited several places there, and tested the gas. With respect to sulphur, on the 22nd of May I found that the gas in Paris, at the Cité du Retiro, Rue du Faubourg St. Honoré, where I had a room placed at my disposal, contained 15·6 grains in the 100 cubic feet. On the 23rd I again tested at the same place. Those tests extended pretty nearly over the whole day, so as to get a fair average, and the gas contained 15·34 grains; and on the 24th at the same place it was 15·12 grains. I also tested on the other side of the Seine, at the Boulevard Mont-Parnasse, and found the sul-

phur to be 11·5 grains I took my own apparatus, which was tested immediately before we went, and immediately after we came back, and we found it quite correct.

Cross-examined by Mr. POPE: I did not visit the gas-works, and do not know what process of purification they were employing or what coal they were using.

Re-examined by Sir E BECKETT: I agree with the French witnesses that there was no nuisance at all.

By the COMMITTEE: Our tests were made with the Referees apparatus, just as used in our official testing-stations.

Mr. *G. W. Wigner* recalled, and examined by Sir E. BECKETT.

I made the tests in Paris conjointly with Mr. Heisch, and I also analyzed the liquor which was brought home for that purpose independently of him, and our results agree.

Sir E. BECKETT said that was all the evidence he proposed to trouble the committee with.

Mr. POPE said that Mr. Jones, of the Commercial Gas-Works, was in attendance.

The committee-room was ordered to be cleared. On the counsel and parties being called in,

The CHAIRMAN said: We think it as well to call the manager of the Commercial Gas-Works before Sir E. Beckett addresses the committee.

Mr. *Robert Jones*, examined by the COMMITTEE.

I am not called by any gentlemen on the opposite side of the table, and I wish it to be understood that I am here alone in deference to the wishes of the committee. I have read Mr. Bramwell's evidence, and, so far as his description of the machinery goes, and the manner of our dealing with the lime, it is quite correct; but he was not correct in saying that we were able to reduce the bisulphide of carbon to 13 grains without creating to some extent an offensive effluvia. The night before Mr. Bramwell's visit the return from the tester of our district gave me an impurity of bisulphide of carbon of 13 grains; but Mr. Bramwell did not see any of the purifiers opened, nor did he see the process of discharging. We had worked for something like two months, preceding the time of Mr. Bramwell's visit, at an average of 13½ grains, and, therefore, so far, he was right about the degree of purity.

The COMMITTEE: As to the possibility of avoiding a nuisance?

Witness: Whilst discharging our purifiers, with that degree of purity of bisulphide of carbon, we had offensive smells at the works; it did not go much beyond the works, but we were complained of by our officers situate some distance from the site of the purifiers. It was impossible for us, with the lime in the state of sulphide of calcium, to have avoided it. We have taken every possible care to discharge the vessels and to carry away the lime without causing any nuisance to the neighbourhood. We have been able to effect a very great deal by the care we have bestowed upon it, but it has been impossible to prevent the smell travelling some distance. Those [pointing to the plan] are the purifiers that we are dealing with, and here, I have often had complaints from the officers—from the secretary especially—that they had a very foul smell in their offices which are situated about 220 yards from the purifiers. Mr. Bramwell's visit was on the 25th of April, and about that time the bisulphide of carbon was 12·7 grains, but owing to the smell being greatly complained of in our offices, I ran the purifiers longer, with a view and a desire to carbonate the lime, and so to destroy that offensive smell. Upon the 26th of April the bisulphide of carbon went up to 14·8, and so it went up constantly until we got to 16·8, 18·2, and 24 grains. Upon the 4th of May it reached 29·3, and upon the 5th to 30 grains; but when we reached that far, I ordered my people to stop that purifier, and to discharge it; and when I saw the lime it was much less offensive than the lime which gave us the results of 12 and 13 grains. It then went down from 30 to 22 upon the 7th, and again upon the 8th to 13·9; and since that time I have been keeping it at from 12 to 11 and 10.

The COMMITTEE: As we understand your evidence, it is this: You have discharged purifiers with a low amount of sulphur, and you have had occasional complaints from your servants, and from nobody else, that there came a foul smell when the purifiers were opened?

Witness: Yes.

Then Mr. Bramwell came on the 25th of April, and his visit was followed by further complaints from your men, which led you to relax the purity which you had previously had. You approached, I think you said, 30 grains, and then discharged the purifier. Was there no complaint made then?—No. When we had got up to 30 grains I ordered the purifiers to be discharged, and the lime was almost innocuous. Some parts of it were wet, and some parts of it were dry, but it had assumed another colour entirely. That was the colour of the lime from a vessel that we discharged on Saturday last [exhibiting a bottle]; the colour of the lime that we discharged on the 5th of May was much lighter; in fact, it had almost come back to its original colour. We could scarcely trace the dark appearance it presents here.

Was the lime equally noxious, the part of it that was dry and the part of it that was wet?—No; I could have stood over it without any inconvenience whatever whilst it was being loaded into carts to be taken away. The lime is not in a very moist state when taken out at any time. Some portions are a little moist; but the major part is dry. The wet lime is the most offensive in smell. There is no greater difficulty in discharging it in a dry state than in a wet state. When I speak of a wet state, I mean a semi-sticky state. I do not think it would be possible to discharge it always in that dry state if we take out the bisulphide of carbon to the extent that we have been doing. Our present maximum is given by the Referees as 30 grains, but that was because we had not our purifiers complete when they made the test. Our purifiers are within a roofed-in building with certain openings to give the men light, and also to give them an amount of air. I put them into those buildings with the intention of confining the smell as much as possible to our own premises, and to some extent it has had that effect. There is a double roof to the building, and in each of the roofs we have six ventilators, three on each roof.

Then the fact is that you have not any great complaint, upon that particular ground, from the men working?—Yes, we have indeed; and the men themselves, since we have been using lime, have applied to me for an increase of wages, and for spectacles, with a view to prevent their eyes being attacked.

Would it not, so far as it is disagreeable for the men, be mitigated if you had a chimey sufficiently tall to create a draught and ventilate the building?—I think not, because we have openings in the walls as well, with ventilators in the roof, so that there is no complaint at all of want of ventilation in the house.

The committee wish to understand how far you question the statement of Mr. Bramwell, which was very much in favour of the way in which the whole of the operations were conducted at your works?—Mr. Bramwell stated everything correctly, except the fact that he met nothing disagreeable himself when he was there, simply because we were not discharging a purifier at that time, and the barge lying near to the works, which was loaded then with the spent lime, was covered over very closely with tarpaulin. At no time, when the works were at rest in that way, would it be possible for you to say that there was a disagreeable odour or smell about them.

Were the complaints as serious when you were working at 17 as when you were working at 8 grains?—No; and that was the reason I gave the order. I ran my purifiers longer, with a view of carbonating the lime and driving the sulphur out; and during that time, whilst we were getting on up to 30 grains, and when we discharged the purifier that had worked up to that, and I had reached my maximum, then the lime came out, and it was in a condition then that not many people would notice.

Does not the result depend very much upon the amount of purification governed by the amount of gas you have to produce, having regard to the size of your purifiers and the number of them, and the facilities, and space, and so on, that you have about you?—In my case, my arrangement of purifiers has been a very recent one, and I have plenty of means to deal with the summer and spring and autumn make. I have another large set of purifiers that I am going to bring into action for the winter. Complaints could not be made against the Commercial Gas-Works, that we had not space or capacity; but notwithstanding that I get the nuisance, if I may be allowed to call it so, although I dislike the word exceedingly.

Do you have any complaints in the neighbourhood?—I had a complaint from the surveyor of the district within the last week, but I do not desire that that should go forward, because it is filling people's mouths out of my own, and they will judge me out of my own mouth.

Examination continued: That which I did was with a view, if possible (and without any reference to my being here to-day at all, for I had no idea that I was going to be placed in this dilemma) of carbonating the lime; and when the lime is carbonated, and the sulphur driven off by the carbonic acid, then it comes out almost innocuous. The longer you run the purifier the more free it is from foul smells, but the gas becomes more impure, of course; there is a greater amount of bisulphide of carbon in the gas.

The COMMITTEE: Does it depend upon running the purifier so many days, or upon opening the purifier after a longer interval?

Witness: Upon running it so many days.

Might you not cease to use the purifier as a purifier, and then not open it for some number of days?—It would make very little difference indeed if we were to take the cover off within a few minutes after the purifier is exhausted. By watching to see what quantity of bisulphide of carbon is left in the purifier after it has ceased its operation, then we might lift the lid either within five minutes or after 24 hours; it would make no difference in the state of the lime. Our purifiers are very large, and we are now only discharging one a week.

Supposing you used it for a week, and did not discharge it till the end of the second week—not using it in the second week, but simply keeping the lime there—would not the nature of the lime be so changed by that as to diminish the nuisance resulting from cleaning it out?—Not materially, I think; besides, we could not spare a purifier for so long as a week. The men have to prepare one after the other; but, notwithstanding that, I believe it would make very little difference indeed.

Before you opened the purifier, had you ventilated it according to the process pursued at Fulham, at Mr. Vernon Harcourt's suggestion?—I do not know the process at all.

A MEMBER of the COMMITTEE: I was at the Fulham works yesterday, and saw a purifier opened, and the whole process gone through from beginning to end. The purifier had been ventilated before it was opened, and when it was opened the lime was in a very dry state. There was a great quantity of sulphur through it, but it had been ventilated, and certainly I could hardly detect any smell at all, though I stood directly where there was a strong breeze, and my coat was covered with this dust. The effect of the ventilation had been, that when the purifier-lid was lifted, of course, there was a slight and rather a disagreeable smell, but none after the purifier-lid was first lifted; and as the three different layers were dug off there was not any serious smell, either within 5 yards, or 20 yards, or 100 yards of the place. Now, do you think that, if you had adopted the plan of ventilating for a certain time—not as long as to run any risk of combustion, or to produce any injury to the purifier—before you opened it you could have avoided the smell at your works, as I saw it avoided at Fulham?

Witness: I have had no experience of that description at all; but, consulting my own feelings, and seeing that this matter is much in the hands of the workmen, I should have some little terror about it. I think it possibly would be successful, and the only fear I should have would be the danger attending it.

Sir EDMUND BECKETT, in commencing his remarks on behalf of the opponents of the Bill, said the present case reminded him a good deal of the course taken on the first general gas Bill relating to the Metropolis in the year 1860. There, as here, different impressions seemed to have arisen at different parts of the case, and the committee expressed opinions which they very candidly allowed to be modified by what took place afterwards, and when they came to a matter of difficult science like this, it was not at all unnatural that that should be the case. He remembered in 1860, on a certain Friday, the committee gave expression to some opinions which delighted the gas companies very much, but on the following Monday morning, after some further evidence, the views of the committee were materially altered, and the result was that the gas Act of 1860 was passed, which was considered then a sort of charter for the public against the gas companies on the one hand, and on the other hand a sort of charter for the gas companies themselves. But some difficulties were found afterwards by those representing the public; and the consequence was that attempts were made, partly by the Board of Trade, partly by the Corporation of London, and partly by the Metropolitan Board of Works, to obtain some modification of the Act of 1860; and after three years discussion in Parliament—namely, 1866, 1867, and 1868—another Act was passed by a committee, presided over for two years running by Mr. Cardwell. This constituted a sort of second charter or settlement of terms between the companies and the public, as represented by the Corporation and the Metropolitan Board of Works. It was necessary to remind the committee that part of the arrangement of 1868 dealt with the sulphur question in a way suggested by the companies themselves; and, as might be remembered, they objected to the enactments of 1860, by which a hard and fast line of 20 grains of sulphur was prescribed, and they suggested Referees. The committee of 1867 and 1868 approved of the suggestion, and the clause appointing the Referees was drawn by the ablest hand they ever had there at drawing clauses—namely, his learned friend, Mr. Burke—so that it could hardly be said that the Referee clause of 1868, if it had any fault at all, erred in the direction of being unfavourable to the gas companies. In point of fact, as appeared by Mr. Evans—the leader of the battle on the other side—the companies thought it an extremely good clause; and it was only because it had not turned out as good as was expected that they were now trying to alter it. Having entered into an agreement with the Metropolitan Board and the Corporation as lately as 1876, it would be an act of rather rapid retrogression to immediately afterwards try to alter the arrangement with which they were satisfied at the end of the previous year. The course of legislation throughout had been an attempt on the part of Parliament and of the public bodies to keep down the quantity of sulphur in the gas to as low a minimum as possible, and it would require very much stronger evidence than any which had been given to induce the committee to pass a Bill of that kind, if there were nothing else in it. The company protested that they did not mean to throw any reflections upon the Referees, but they

had proceeded throughout to throw as much odium as they could on them, and had applied to them a great variety of epithets. One or two gentlemen on the other side charged them with incompetence, and Mr. Michael cross-examined one of the Referees at great length to prove that they had no practical experience, while Mr. Evans, who did not stick at trifles, took the bull by the horns, and said if they had only acted conscientiously he could get on pretty well, but they did not. Another witness on the other side boldly said they were unfit for their place; indeed, from the beginning to the end of the case, the counsel and pretty nearly all the witnesses who had any excuse for so doing, used language reflecting upon the Referees. It did not appear to have occurred to the company that if the Referees were inefficient, unqualified, unfit for their place, and did not act conscientiously, that the proper thing for them would have been to go to the Board of Trade and say, "Gentlemen, you have appointed officials having all these disqualifications, but you are not bound to reappoint them. Pray do not reappoint these three gentlemen; they are unconscientious, and all these things." There was not a single thing which the company had stated to induce the committee to pass their Bill that they could not have stated to the Board of Trade, and which that Board could not have dealt with. Had there been any proposal to change the Referees? The various public bodies interested had not insisted that the same Referees should be appointed; and if Mr. Evans would tell his story to the Board of Trade, they are bound to assume that the Board of Trade, being a judicial body, would appoint either one or two fresh Referees, or give some chance of their bringing their case before somebody else. A singular thing was, that the Referees should have been satisfactory to the companies during the period when Mr. Evans himself was a Referee, because he contrived so to modify their views that they did not stipulate for anything lower than 40 grains. How Mr. Evans came to be appointed a Referee he (Sir E. Beckett) did not know. He seemed to be not at all the kind of man; but there were underground ways of doing things which gas people knew as well as other people. They got him appointed, but naturally the appointment made such a row that he was obliged to retire, and as soon as he retired a new state of things arose. Then they got "unconscientious Referees," who began to behave ill when they began to carry out the Act which they were intended to carry out, instead of being bullied out of it by a gentleman like Mr. Evans. He was saying that they began to complain, but they did not begin to complain till last year. They took care to get all their money first; they got all their pecuniary arrangements ratified by Parliament, they got their amalgamation with the Imperial, and a variety of other small companies; and they got the price of gas sanctioned by Mr. Forster's committee on the express footing that the extra purification involved a greater price. It was true the company said they were willing to have that matter re-discussed, but the public bodies were not going to hamper themselves as to future proceedings by discussing any detail of that kind. They insisted upon the bargain made as lately as last year, and were not going to discuss financial details. The correspondence showed that the whole matter was in the nature of a personal fight between Mr. Evans and the present Referees. Mr. Evans, indeed, confessed that he could not bully the Referees into submitting to him, as he had succeeded in bullying or persuading them when he was one himself. It was nothing but a personal dispute, between Mr. Evans and those Referees, who was to get the best of it, and if they could carry out of that committee any Bill substantially modifying the present state of things, even to the extent of the 30 or 33 grains, Mr. Evans would say, "I have licked the Referees—I told them I would, and I have." The question was, whether Parliament would help him in doing that. The learned counsel then read several extracts from the evidence given by Mr. Evans, and contended that that evidence so bristled with contradictions that it could not be opened anywhere and contrasted with the statements of the Referees, as to matters of fact, not opinion, without seeing that Mr. Evans was inventing a case for the Bill. It was his Bill throughout, and was a personal fight between him and the Referees. Then they had another excuse, which was inspired by Mr. Evans. The great difficulty which had come upon them quite suddenly and unexpectedly had been the amalgamation with the Imperial. His learned friend said it was the *damnosa hereditas* of the Imperial which had brought it upon them. Why did they buy the Imperial? They bought at the critical period between 1875 and 1876; that was, they got all their financial arrangements through Mr. Forster's committee, and power to divide, not only 10 per cent., but as much more as they could consistently with the sliding scale; and although the sliding scale was complained of at the time, yet Mr. Evans said it had been a very profitable thing for them, in consequence of the fall in the price of coal. Having got it, however, and having waited to see the result of it, they then bought up the Imperial to please themselves, and then they used the Imperial as the excuse for getting rid of the obligation to reduce the sulphur, because it would have beaten even Mr. Evans to find an excuse for getting the free and unadulterated Chartered Company out of that obligation. He knew he would be met with the fact that he had told every committee in Parliament that at Beckton they had the means of making all the gas that they possibly could require out of London, in a place where stinks were indigenous, and therefore the *damnosa hereditas* was necessary. The attention of the committee was seriously asked to the question whether the time had not arrived when the manufacture of gas ought to be turned out of London altogether; and if it should be the case that the company could not make pure gas without creating a nuisance, the true answer to that would be, "Very well, then; make none in London. Make it all at Beckton and at Bow. You have said over and over again that you can; now go and do it,"—and would not that be an enormous benefit to London? So much for the *damnosa hereditas* as regarded the Chartered Company. But the Imperial Company had an existence long before the Chartered Company thought of this scheme, and had been purifying gas since 1860, at any rate, down to 20 grains, and 25 grains, and so on. The Imperial never found any difficulty, and they had not been a company particularly given to submitting to parliamentary requirements. As regarded the question of purification, Mr. Evans said: "We should, if we were allowed to go back to the oxide of iron again, use a little lime for the carbonic acid." If they were allowed to go back! Who ever stopped him using the oxide of iron? It was utter recklessness on the part of Mr. Evans to say that they were obliged to give up using oxide of iron. What obliged them? They might choose to give it up because it would cost them more money to use oxide of iron and lime, but that was no business of any one else's. Surely people who had a ten per cent. dividend, and practically the means of earning as much more as they liked on the sliding scale, were not the people to talk about their poverty. Why ought they not to be called upon to use the best possible means? One of their best witnesses—Dr. Tidy—said he would not regard it as a question of money. Unless he (Sir E. Beckett) was greatly wrong, Mr. Evans seemed to have entirely failed in the basis he laid for the present case. His basis was, that he was obliged to give up using that very thing which another engineer of equal experience said he did use, and used with success. What Mr. Anderson could do at Dover, at Cork, at Waterford, and at some other places, though they were not so large as London, of course Mr. Evans could do; and with regard to the difficulty of getting rid of the lime, that was obviously a mere question of money. The Essex Marshes were big enough and low enough to be able to receive all Mr. Evans's lime if he chose to send it there. At the same time, two or three witnesses upon the other side said they believed he used about five times as much lime as he need. They might be right, or they might be wrong, or the truth might lie between them; but, whether it was much or little, Mr. Evans must pay for taking it away if he was encumbered with it. Another question was whether Mr. Evans pointed out that difficulty in 1866. Could any human being believe that it came upon him by surprise, and that it was any part of the *damnosa hereditas*, because the lime he had received with that *damnosa hereditas* was lime made at Fulham, St. Pancras, and other places, and had nothing to do with the lime at Beckton? He knew that in 1875, in 1868, and in 1867, and it was really only another trumped-up excuse. Of course it was necessary to his case that Mr. Evans should make out that the Corporation of London and all the chemists upon their side, and even one or two upon his own side, were entirely wrong in saying that there was any importance in getting rid of the sulphur. When it was necessary, he was chemist and everything else, but Mr. Evans denied that there was anything in the sulphuric acid story, although it was proved most distinctly by chemists without end that the sulphur left in the gas, by the aid of the oxygen in the air, multiplied itself into three times its bulk of sulphuric acid; and then at some place or other Mr. Evans said that that was all a delusion, and that the complaints were "rubbish;" but Dr. Tidy, one of the most distinguished witnesses on the side of the gas company, clearly stated that he did not agree with Mr. Evans in saying that the public apprehension about sulphur was a delusion. All through his evidence he said that in the present state of science he thought they ought to be allowed as much as 35 grains, but that if he could see his way to it being reduced even to 10 he would do so. There was also the evidence given upon the Crystal Palace Bill, of Professor Barff, Dr. Frankland, Mr. Pattinson, and others, and with all that staring the committee in the face, what view of the case were they going to take? It was a fairly open question how much sulphur could be got out without making a nuisance; but to talk about the sulphur being no nuisance was mere recklessness of swearing, and they would have to consider how far that reduction, if at all, could take place, and ought to take place. The Metropolitan Board and the Corporation, as representing the public, were not fighting for mere victory; they were fighting because sulphur was a bad thing, and ought to be got rid of, if it could be got rid of without inflicting some corresponding or greater nuisance. He (Sir E. Beckett) did not know how it would be possible, consistent with logic, after having rejected the Crystal Palace Bill, which contained an absolute limit of 20 grains, to pass the present Bill with any modification, giving the Chartered Company something more than 20 grains, whether it be 30, 33, 35, or anything else. It would be a strong result for the company to obtain; but he thought Parliament would have sufficient regard to its own logic not to attend to that, even if the Board of Trade were satisfied. People talked of the Board of Trade as if they were a sort of incarnation of wisdom; but they were not always found to be so. The Board of Trade did not represent the people of London, but the Metropolitan Board and the Corporation of London did, and they flattered themselves that they could judge just as well as the Board of Trade. The committee knew ten times more about it than the board could do, as they had not heard the evidence.

The CHAIRMAN: I am afraid you must not shift the responsibility in that way; the suggestion, be it good or bad, is not in any way referable to the Board of Trade. I thought it as well to consult them as to whether they saw any difficulty in working it out in case it should be adopted, but the responsibility for the suggestion rests entirely with the committee, and I should say more properly with the chairman, and therefore I think you may leave the Board of Trade alone at present.

Sir E. BECKETT said he thought it would not be respectful if he had not said something about them, as many people would rather be abused than not noticed. He hoped the chairman would take the responsibility upon himself, and not think of being influenced by anybody in the Board of Trade. Another suggestion had been made by the committee—viz., that there should be a kind of substitute for the Referees—somebody to be appointed by the Board of Trade to inquire from time to time, and have experiments made at the gas-works; but he would like to know how that person, or those persons, would differ in substance from the Referees, excepting, as he understood, those persons would not be able to act except upon experiments conducted for them by Mr. Evans, who would, doubtless, conduct them with the utmost sincerity; but it must be remembered what Mr. Bramwell's view was of what his position would be if he were a Referee appointed under those conditions. He (Sir E. Beckett), speaking again for the public, entirely dissented from having any persons appointed to judge their rights and interests, upon the condition of being obliged to carry on experiments by the aid of their enemies, because they would have an interest in doing as little as they could, and getting as much as they could; in other words, he required, on behalf of the Referees, the most unlimited discretion. Turning to the question of nuisance, as regarded actual nuisance, he admitted there was plenty, but as to the necessary nuisance he did not admit so much. It was very true that evidence on behalf of gas company was necessarily negative evidence and, therefore, inconclusive, but it was not the less negative evidence, because it was necessarily negative. Negative evidence was very good till it was either helped or contradicted by positive evidence, but when it was met by positive evidence it did not go for much. If there was a distinct proof of one single gas-work in the world where the purity was kept down to anything like 20 grains, with the same kind of coal, without creating a nuisance, that would answer the evidence of every gas company in London, and in every large town in England; but, strange to say, there was none from any other town to the effect that they could not prevent the nuisance. They had had the evidence from the Paris gentlemen about the coal they use—practically it was the same coal as used in London at the present time—and they kept their sulphur down to 15 grains, and there was no nuisance. The Referees had made a very great mistake in ever trying to teach the gas companies how to do it. If he (Sir E. Beckett) were a Gas Referee, if they asked him, "What do you want done?" he should reply, "Want done? I want the sulphur kept out." "How are we to do it?"—"Go and find out at Nottingham, Leeds, Pontefract, Dover, Newcastle, and all these places, what they are doing; do not ask me to teach you your work. I am here to test what you do, and I am here to learn as well as I can, with such information as I can get, whether the sulphur can be kept out to this extent." The learned counsel read several extracts from Dr. Frankland's evidence on the Crystal Palace District Gas Bill, and contended that that was chemical evidence of the highest eminence, in confirmation of Mr. Anderson's practical evidence, and he thought, with those two things together, there could be no doubt that Mr. Evans was as wrong as he possibly could be, not merely practically but scientifically, in talking about his being obliged to give up the use of oxide for the lime. It was very likely that a good many of the smells which had been mentioned were not pure sulphur smells, the public nose was not very sensitive as to smell, and if they smelt anything unpleasant they would probably conclude it was the sulphur in the lime, because they had heard that the sulphur did cause a nuisance. They also had the evidence of Mr. Loam, given in 1876, who stated that at Nottingham they principally used lime for purifying, although they used oxide of iron in the catch purifiers. He also stated that the farmers came with their carts and took the lime away

as they liked, but they had no complaint as to nuisance. That led to another topic. It was thought worth while by one of the learned counsel to ask this question: "In 1873, when the Corporation and the Board of Works brought in a Bill conjointly for buying up the London Gas Companies, did they put in any limitation as to the purity from sulphur?" and the answer was "No" It was thought a great triumph to get that answer; but why need corporations put restrictions upon themselves? There was the Corporation of Nottingham, who had the gas-works, and they had no restrictions, yet they reduced their sulphur as low as they could, because, of course, the public required it. It was really idle to ask a question of that sort. Dr. Pole, one of the Referees, also gave his positive knowledge as a reason for requiring what he did require of the London Gas Companies. He said that he visited Edinburgh, and found that lime was used entirely there; that the works were in one of the best parts of the town,—between Carlton Hill and Canongate—and that he went carefully over them, and spent some days with the manager. He was living in Princes Street during the time when the wind was blowing from the works towards the hotel, and there was no nuisance, and there was nothing in the gas which gave him reason to suppose that it would be impossible to purify it by lime. Mr. Anderson likewise said that he had been engaged for 30 years in managing gas-works, and he mentioned the things that he had used, and also how he used the lime. [Evidence read.] The committee had thus three distinct processes before them: they had Dr. Frankland's statement that at Manchester they did it without any lime at all, or very little; Mr. Anderson saying that he used both lime and oxide; and Mr. Loam's evidence that he did it with lime; so that there were three different ways of treating it, and all successfully. Mr. Heisch, who was examined in the Crystal Palace case, also stated that the Phœnix Gas Company had, since 1860, complied with the 20 grains condition, as a rule, without creating a nuisance. There was also a clerk of the Lewisham Board, and another gentleman, of the name of Edwards, who said the same thing; therefore there was actually a London Company, complying with the 20 grains condition, and doing it perfectly satisfactorily. There was also the case of Bow, about which Mr. Evans stated that the lime, if exposed to the air, became pure after a certain time, and had not much smell. A reference to Beckton was likewise made somewhere in Mr. Bramwell's evidence, if not in others.

Mr. Pope: Mr. Bramwell was never there.

Sir E. Beckett said that Mr. Bramwell stated that he had been to Beckton, to Bow Common, and to a good many other works. He also stated that he had seen the process carried out at Beckton without a nuisance.

Mr. Pope: He never saw the process at Beckton in his life. I say that it is not so.

Sir E. Beckett said that Mr. Bramwell was asked, "Supposing Beckton were in the middle of London, would the lime be a nuisance then?—A. The whole works would be a nuisance. Q. Would not the lime process be a nuisance?—A. I do not believe it need be." Nothing more need be said about Beckton, and, as regarded Bow, Mr. Wigner, as well as Mr. Evans, said there was no nuisance there. As regarded Fulham, it was certainly open to the remark that Dr. Tyndall made, that, when he and his wife were there, and they both had very good noses, although there was every possible means to induce the laws of nature to behave decently, the place would not stink. Then there was Mr. George Livesey, of the South Metropolitan Company, who was not the man to blow his own trumpet, but he told the committee what he managed to do there. He stated that the average result of the testings for the quarter ending Dec. 31, 1876, had been only 17·7 grains in 100 cubic feet. He also stated that in December, 1875, his gas was ten times over the limit of 25 grains allowed during the six winter months, and in the month of January it was ten times in excess; but from the end of January, 1876, up to the end of February of this year, there was not a single excess, and then the excesses came on, although why they came on he never could find out. As regarded Mr. Jones, he (Sir E. Beckett) was glad to hear his evidence, and particularly glad to find that he on no substantial point contradicted Mr. Bramwell, although he could not help thinking that Mr. Bramwell's statement as to what had been done with the purifier immediately before he was there must, from the nature of things, be right rather than Mr. Jones recollection and thinking. Mr. Hawksley had mentioned another mode of getting rid of the nuisance; at any rate, he said very positively that it could be done, not only from his Nottingham experience, but from other circumstances. His friend, Mr. Richards, who cross-examined Mr. Hawksley, thought the best thing he could do would be to throw a little odium upon that gentleman by suggesting that if the company had come to him first they could have got his evidence; but he (Sir E. Beckett) had a very strong suspicion that there had been some very good reason why they did not call Mr. Hawksley, because it would be the most natural thing that he should be the first person they would go to when they wanted a scientific witness. In 1867 Mr. Hawksley was on the side of the gas companies, and therefore anxious to say everything he could for them; but, in the course of his examination, he said that he thought a better mode of purification had been discovered than had at that time been spoken of, and that was, to continue the use of oxide of iron for taking out the sulphuretted hydrogen, and then only using the lime for the purpose of taking out the remaining bisulphide. His opinion was that by the combination of the two processes, the works could be carried on where they were, but that the effect of the double process meant a cost of about 1d. per 1000 feet more. That was a tolerably good reason why the companies did not ask Mr. Hawksley to give evidence for them; but they might as well have had the decency to look at that matter before they made that charge. Having gone through those different descriptions of the modes of doing this business, he (Sir E. Beckett) thought that if there had been only one instead of about a dozen, that would be a decisive answer to the allegation on the other side that sulphur down to 20 grains could not be got out without creating a considerable nuisance. It was plain that it could, and it was also plain that one of their most valuable witnesses, Dr. Tidy, was convinced that it ought to be done, if it could, though he did not know the means by which it could be done, although other people did. He made a suggestion which appeared to be a very pregnant one. He said they ought to pay for having sulphur in, which probably meant that if they were to be let off a certain amount of sulphur, they should pay some kind of penalty for every 5 grains so let off. Mr. Vernon Harcourt also said he would rather pay twopence more and have the gas pure. There had not been a single scientific witness worth talking about who had attempted to prove that there was any real difficulty in complying with the Act of 1860, much more with the requisitions of the Referees, which were at any rate five degrees easier in winter, and might also be made five degrees easier next winter if they could convince either the present or some other Referees that they ought to be relaxed to that extent; but, on behalf of the two public bodies, he (Sir E. Beckett) protested entirely against that very recent bargain, which was a continuation of a previous bargain, being relaxed now, simply and solely at the instance of Mr. Evans and the Chartered Company.

Mr. Round said he did not wish to make any remarks in a partisan spirit, because the Board of Trade, by whose instructions he appeared, desired to express no opinion whatever upon whether it was politic or not to do that which the gas company were asking the committee to do. But at the same time, inasmuch as the Bill, if it passed, would withdraw from the jurisdicton of the Referees the power vested in them of determining what amount of impurity in the form of sulphur should be allowed in the gas, he thought it was not otherwise than relevant to the question to see how far the Referees had discharged that duty which Parliament had imposed upon them in reference to the legislation affecting gas. He thought there could be but one opinion in the minds of all who had followed this inquiry, that those gentlemen had done themselves infinite credit by the way in which they had discharged their duties in conformity with their instructions, and with the spirit of the Act of Parliament. He thought also that there could be no two opinions that they had an extremely delicate and difficult position to fill, and a somewhat invidious one, which they had succeded in discharging to the utmost reasonable satisfaction of everybody who had had an interest in the way in which their duties were being discharged. It is quite clear that the Acts of Parliament under which they had jurisdiction provided for more than the entire removal of sulphuretted hydrogen, and that idea could not be better expressed than in the way those gentlemen had themselves expressed it in their letter of March 5, 1877, in which they said that "it is clearly the intention of the Acts now in force, that the gas company shall be requiried to reduce the amount of sulphur in all forms, as well as wholly to remove sulphuretted hydrogen. The question we have had to decide is, how far this amount can be reduced, considering what is reasonable, and especially the necessity of avoiding nuisance." That was the interpretation—and a correct one—which they had put upon the Act imposing those duties upon them, and it also put them at once right as to the limits within which they had conducted their inquiries. He was perfectly certain that those gentlemen did not require any vindication on his part, for they had amply vindicated their appointment by the Board of Trade as the most competent men that could have been found to undertake the duties imposed upon them; but there had been one or two remarks thrown out by them which ought to have been met in a different way by the promoters of the Bill, and they were mentioned with a view to the justification of the course which the Referees had adopted. Those gentlemen, in the letter referred to, pointed out what, in their opinion, had been the cause of the increase of nuisance which had arisen within the previous six months, although the proportion of sulphur—namely, 20 to 25 grains—had been in operation for four years, and they put forward a very strong opinion upon that point. They found that there was not an uniformity of system at the different works of the company; they found that what was good at one works was not carried out at other works, and it took a twofold form—first of all, there was the process of opening the purifier, and the mode in which they ventilated the lime, and endeavoured to get the gas free from those impurities. The next thing, distinct altogether from that, was the way in which they removed the obnoxious lime after it had answered (or was supposed to have answered) its purpose. They found that the purifiers were under cover at Kensal Green, Pimlico, and at Beckton, but that they were not under cover at Fulham, Bromley, and at Haggerston. The inference to be drawn from that was, that if it was a good thing to put them under cover at one place, it would be at all, and the committee were doubtless impressed, to a certain extent, with the view that it would be better that the purifiers should be under cover. Had the promoters proved that that statement was wrong, or had they called any gentleman who could contravert the opinion which the Referees had expressed? Again, the process of removal varied. Fulham, which was deficient in one respect—namely, that the purifiers were not under cover—contrasted favourably with other works as regarded the removal process. The Referees naturally said, "Why can you not take the same precautions at other places with regard to the removal of your refuse as at Fulham?" And it might have been expected that the gas company would have shown why they did not; but they had done nothing of the kind. There was another point, which Mr. Vernon Harcourt mentioned, but which had not been alluded to again in the inquiry, and to which, in justification of these gentlemen, the attention of the committee should be drawn—viz., that they were not to act as the companies engineers, but to point out to them that, if certain things were not done, the Referees had a right to expect the companies to show how far that which they had done was right; but there had been no such evidence. Mr. Harcourt stated he tried an experiment which was ultimately terminated, not because the process failed, but because of the accident which had happened to the apparatus. Then he said, "My belief is, that if the company were willing to make a trial of this process it would be practicable to overcome the engineering difficulty, but more than I have done in the matter I cannot do; it must rest with the company to try it or not." Subsequently a question was put by the chairman: "You think that it ought to have been followed up?" To which Mr. Harcourt replied: "I think it is an alternative process. I have already expressed my belief that this process of purification by lime is practicable. I think that, with those improvements which Mr. Evans has introduced, it may be continued without nuisance; it accomplishes as complete a purification as the heating process would accomplish." He (Mr. Round) alluded to that part of the evidence more particularly, because it seemed to have been assumed throughout this inquiry that gas could only be purified by lime, and that it necessarily followed that an additional nuisance was created by that lime. The Referees said the alternative process could be adopted, and that they had not advanced anything that was not a practical matter; and if they retired from that room with the impression that nothing they had heard had changed their opinion in any way, it was because the other side had not shown that those testings which had been made from time to time by the Referees had not been fairly carried out. The committee would see how difficult it was for these gentlemen to act if, when going to one work, they found Mr. A. doing one thing, and on going to another work they found Mr. B. doing another, and then on going to another work they found Mr. C. doing a third thing. As they pointed out in one of their letters, they said: "It might naturally be expected that a gas company supplying more than half of London, and having about £7,000,000 of capital, would have some eminent responsible and active head engineer to direct and control their scientific and manufacturing arrangements. But there is no such officer. Mr. Evans (whose great knowledge, ability, and experience are known to the Board of Trade as well as to ourselves) no longer occupies this position; and the management is in each case left to a local superintendent of the special place of manufacture. We have no reason to doubt the competency of these gentlemen for the positions they hold; indeed, we know some of them to be men of ability. But we notice among them a singular diversity of opinion and practice, and some disinclination, perhaps natural, to cope with a problem new to their experience. They have expressed their readiness to try any suggestions made by us; and we have pointed out some of the more obvious defects in the processes we have seen; but it is not our province to act as the company's engineers or chemical advisers. The absence of any well-qualified technical head with whom we could communicate on the general problem has been a source of continual inconvenience, and we are convinced that if the subject were earnestly taken in hand by a person so qualified, all the difficulties attending it would soon disappear." Upon that he would ask, had there been a single tittle of evidence addressed by the other side why there

should not be such an adviser appointed? The Referees having explained in such a lucid and satisfactory manner the way in which they had discharged their duties, he (Mr. Round) felt that it would not be otherwise than becoming in him to point out that the other side had not shown that anything which the Referees had advanced was otherwise than perfectly compatible with what might be done, and that they had discharged their duties in a manner entitling them to credit, and to the great satisfaction of those who appointed them.

The CHAIRMAN: With regard to the remarks you have just made, I would say that, as to the exercise of the discretion vested in the Referees with regard to this question, that is a subject upon which I will express no opinion until the committee deliver their decision upon the whole question before them. As regards their general capacity in fulfilling the office which they hold, that is not a matter into which the committee have any right at all to enter. It would be, I may say, impertinent for them to express any opinion upon that subject; but, so far as regards the manner in which the Referees have given their evidence, I may say, with the concurrence of the others members of the committee, I am sure that it has been entirely frank and satisfactory; and I think, as we asked these gentlemen to attend, not as witnesses upon either one side or the other, but to throw light generally upon the subject, they were quite justified in giving their evidence as they did.

Mr. ROUND: Upon their part I thank you for that expression of opinion.

WEDNESDAY, JUNE 6.

Mr. POPE, in replying upon the whole case, said, he would not follow Sir E. Beckett into the vein of personal observation. It was difficult to recognize his learned friend in his new mantle. They had been accustomed to regard him as the champion of the gas and water companies in Parliament and out of Parliament, in the colums of *The Times*, and in every capacity in which he could bring his versatile genius to bear upon the question; but he had now decently wrapped himself up in the mantle of the Metropolitan Board of Works and the Corporation, although the cloven foot peeped from beneath now and then. His learned friend had hoisted Mr. Evans into a position, with regard to the present question, which must have astonished him. It appeared that the whole case was the invention of Mr. Evans, for the purpose of enabling him to carry on a personal contest between himself and the Referees, and that gentleman had been charged with inaccurate statements and violent language, which should rather have commended him to the attention of his learned friend than have induced him to visit Mr. Evans with his censure. He (Mr. Pope) really thought the best thing he could do was to brush aside all stuff of that kind; and he would again state, as he stated at first, that he did not desire to say anything with regard to the Referees, except to speak of them in terms of the most profound respect. The most which he had said, and the most Mr. Evans had said, though he spoke it in rather plain language, was that the Act of Parliament provided that one member of that tribunal should have a special qualification and a practical acquaintance with the manufacture and supply of gas; and all that had been said with regard to the eminent gentlemen who had been in the box had been, that it did not at all follow that an eminent chemist, or even a professor of physics, was necessarily practically acquainted with the manufacture and supply of gas. Sir E. Beckett had asked that there should be no change in the legislation either of 1868 or of 1876; and so far as his argument was addressed to that view, he (Mr. Pope) would endeavour to deal with it respectfully and with consideration; but beyond that they seemed to have arrived, by general consent, at some notion of what the real question was they had to discuss, and to try whether it was worth while to insist upon the adoption of the lime process of purification for gas. That was really the simple question, and it was not now made in the interest of the company, but it was a question of the balance of advantage or disadvantage in the interest of the public purely. He was not instructed to urge one argument in the interest of the company upon the score of any expense which such a process might occasion, if it was a necessary thing that the lime process of purification should be adopted; but when the committee came to consider the question as a balance of advantages and disadvantages, they must not look at the suggestions which his learned friend had thrown out, but at the facts as they appeared in the evidence. It was not proposed at present to enter upon the general question of whether the presence of sulphur in gas was or was not absolutely injurious. That was a question upon which opinions differed, and might reasonably differ. Chemists of very great eminence on the one side entertained an opinion which was not shared by chemists of equal eminence on the other; but, in a matter which was at least open to grave doubt, in all probability the benefit of that doubt would be given to the public rather that to the company, however onerous the conditions imposed upon them might be. Therefore, as regarded that condition, the committee would not be asked to affirmatively decide that it was of no consequence to the public whether any sulphur impurity existed in the gas or not. But, in the face of the evidence, he (Mr. Pope) thought he was entitled to ask the committee to come to the conclusion, that it was of very little consequence whether the amount of that impurity should be 20 grains or 40 grains as a maximum; whether the average, so to speak, was from 15 to 17, or from 33 to 35; and he was justified in saying that, because Mr. Harcourt himself very frankly said so too. Mr. Harcourt certainly afterwards stated that it did, in his mind, represent a certain pecuniary value on the article or the commodity which he obtained; and that, if he could get perfectly pure gas for 2d. per 1000 feet more than gas containing sulphur impurities, the tendency of his mind would be to prefer the pure gas at the extra price rather than run the risk of the sulphur. But beyond that Mr. Harcourt did not venture to say; on the contrary, he said that it was at least of very little consequence. The learned counsel read the evidence given by Mr. Harcourt on that point, and said he had done so because it seemed to involve the three concessories upon which the company might found their argument. One was that the mischief which the prescriptive maximum sought to cure, and which the lime process was looked upon as necessary to cure, was one of no great consequence to the consumer. It was not, therefore, the great and mischievous evil which the Metropolitan Board and the Corporation seemed to think, inasmuch as the restrictions or prescriptions were to be reasonable. One of the first elements in the consideration of the reasonableness of a proposal was whether the remedy was commensurate with the mischief, or was larger than was necessary, in order to get rid of that inconvenience. The evil of the presence of 20 grains of sulphur, it had been conceded on the other side, was of no great consequence to the consumer; and it was further conceded that if it should turn out that, in order to obtain an advantage, inevitable mischief was occasioned to the whole public, then the figures need not cost the committee much trouble as to what they should be relaxed to, because the alternative was a maximum of 40 grains; and he (Mr. Pope) might say at once, on the part of the company, that whatever might be the view which the committee ultimately entertained as regarded the progress of invention, as regarded the adoption of other processes, and as regarded the invention of machinery by which that might be developed or insisted upon, they would be entirely content if, instead of passing the Bill in its integrity, the suggestion which he ventured to throw out at the commencement should meet with their assent—namely, that the maximum, instead of being 20, should be relaxed at present to a maximum of 40, or, if it should be preferred, such an average as that represented; leaving it, of course, in the discretion of the committee to deal with other parts of the case in the manner they sketched out in the suggestions which they laid before the parties previous to Whitsuntide. Sir E. Beckett had contended (and in that seemed to lie one of the fallacies of his argument) that it was the duty of the Referees simply to lay down a sort of canon, with which the companies must comply. In other words, his theory was, that if the Referees came to a conclusion in their own minds that a maximum of 20 grains might be prescribed without nuisance, it was their duty to prescribe that maximum, and leave the companies to carry it out at their peril, and if the lime process would not do it, to find out something that would. That was not the intention of the legislation of 1867 or 1868. What was it that Parliament had said was to be the rule in that matter? Not the will of the Referees; not even the opinion of the Referees, however earnestly and however honestly entertained, but it was: "The Gas Referees shall from time to time ascertain with what degree of purity the said company can reasonably be required;" not "absolutely," but "reasonably." The reasonablenes of the requisition was to be a matter which was to enter into their consideration. Could it be contended that it would be a reasonable thing for a body of gentlemen, who entertained scientific opinions of their own, simply to force those opinions at the peril of the companies, without being able to suggest a mode by which they could be carried out. In the present case there was a remarkable feature—that there had not been a single instance in which the Referees had suggested anything which could be carried out, which had not been carried out by the companies *bonâ fide*, in good faith. Mr. Harcourt had had an opportunity—perhaps not to the fullest extent he would desire, but at all events to a very considerable extent, and at a very large expense—to carry out what appeared to him a hopeful process, but which had not as yet developed itself into a matter of sufficient practical value to enable him to say, "That is a process which I think you ought to adopt, and if you do adopt it you may accomplish this." All that would be reasonable, but in the meantime where were the company? Were they to be subject to an arbitrary hard and fast dictation on the part of the Referees, however competent, when the Act of Parliament said it must be reasonable, and, therefore, not only reasonable with regard to the make and supply of gas, but reasonable also with regard to the make and supply of gas continuously, and without causing a nuisance. It might be true that there had been days on which, say at Fulham, Professor Tyndall, with his excellent organ, and with the assistance of the olfactory sense of the lady who had accepted his name and fortune, had found it difficult to detect the immediate presence of a nuisance there—it might be from the atmospheric condition; it might be because the process had been working perfectly; or it might be from many other circumstances; but what had to be seen was whether the conditions were such that those circumstances and those conditions were continuous and constant. Of course, if an allegation were sustained such as that somewhat heedlessly and incautiously thrown out by Mr. Bramwell, that the processes were purposely made a nuisance, he (Mr. Pope) did not mean to say that that would be a reasonable thing for the company to insist upon as an excuse; but, on the other hand, what was to be looked to, according to legislation, was some process—the lime process, or any other—which could be employed continuously, without at some time or other occasioning a nuisance sufficient to justify the rejection of that process. It must not be a laboratory experiment, but it must be a reasonable process, continuously producing the proper result as a matter of practical manufacture in the hands of ordinary workpeople, and in the condition of an ordinary process, when that process was carried on, on a large scale, for the purpose of the supply of gas to a large district. That was the meaning of it, and that was the reason why Parliament inserted in the clause empowering the Board of Trade to construct the tribunal, that one of its number should be practically acquainted with the manufacture and supply of gas, not because either Parliament or the companies doubted for one single moment that Mr. Harcourt's knowledge, *quâ* knowledge, was of the highest character, both as regarded gas and as regarded the chemical combinations and results which arose from the manufacture, but because of the difficulties in the practical manufacture which were known only to those who had the management of men and the management of large concerns and operations. Those who had been accustomed to Lancashire and places of that kind, know many instances in which the most perfect and beautiful laboratory experiments utterly failed when they came to be applied by comparative rule of thumb, and also through the awkwardness of the ordinary workmen employed. Under those circumstances, how did the position of matters stand? Was it not demonstrated, as far as evidence could demonstrate it, that, continuously, at all events, the lime process could not be conducted without producing the results of nuisance in the neighbourhood of these works? If that were so, the question seemed to be, was the mischief which was of no great consequence—namely, the presence of 20 grains of sulphur—sufficient to justify the committee in forcing upon the public the lime process of purification? That was the issue they had to decide; and, dealing with the matter logically, there was hardly an escape. He (Mr. Pope) ventured to submit that the view which the committee seemed to entertain (though, of course, they pledged themselves to nothing) before Whitsuntide, was one which might well be sustained now, notwithstanding all the suggestions of his learned friend, Sir Edmund Beckett. What did he suggest? First of all, he said there were various means which might be adopted in order to mitigate the nuisance, and so there were. He said the company might enclose the purifiers in a building, but it was difficult to understand the philosophy of that suggestion. The stink might be bottled up for a time, but out it must come some time or other. When Pandora's box-lid was removed, out must come the contents, whatever the consequence to the public; and if a large mass of gas was penned up in a building, it might increase for a time the inconvenience to the workpeople; but out of the windows, or ventilators, or chimneys, it must come at some time or another, unless it was condensed. Of course, it might be that by having a tall shaft, as seemed to be suggested, the contents of the receptacle might be conveyed to a great height, and then distributed in the atmosphere, so as to diminish the smell, by having a larger amount of air through which it could diffuse itself when it fell to the ground; but, after all, the question came back, not whether, by any exercise of human ingenuity, something could be done which would mitigate the nuisance, but was it reasonable to require all those things to be done, when, after all, it was of no great consequence? It did not appear that buildings would obviate the mischief. At Fulham, for instance, there were no buildings over the purifiers, but at Pimlico there were, and at Beckton there were; and it certainly made one raise one's hands in amazement to find Mr. Bramwell talking of Beckton as not being a nuisance in itself, when Beckton was the place where all the lime was carried to, and where it was distributed upon the surface of the land; where the purifiers were worked the longest; and where, according to Mr. Trewby, the inconvenience was felt the greatest. It was also suggested, though they could not tell how, it is not their duty—but somehow, by some other process, the company were to do the thing without a nuisance, and Sir E. Beckett brought forward some portions of the evi-

dence given on the Crystal Palace Bill; but, looking at that evidence and weighing it, he (Mr. Pope) did not believe they did accomplish the sulphur purification without a nuisance, as they thought they did. Knowing Manchester and its gas-works well, and knowing that in Manchester there was no prescription as to the maximum of sulphur impurity, he hesitated to approach the subject with the intrepidity which distinguished his learned friend, who said that at present they accomplished the purification without a nuisance. He (Mr. Pope) would not undertake to say that they were always making a nuisance; but he would undertake to say that when they did not they were not purifying the gas. But, after all, what idle nonsense it was to take cases in which corporations were the owners of gas-works without restrictions as to sulphur impurity as governing a case like the present. He thought it had almost passed to be common knowledge—the Corporation and the Metropolitan Board of Works must know it well enough—that the public would submit at the hands of a public authority to things which they would resent with an outcry if they were in the hands of a private company. If, instead of being The Gaslight and Coke Company, the Corporation were manufacturing the gas, would there have been any outcry upon the part of the public, either as to sulphur impurity or anything else? Clearly not; people looked upon nuisances inflicted upon them by their governing bodies as something which they could not help, and they would not enter into a contest with them. As regarded Dover, there was no analysis of the purity of the gas, except such as Mr. Anderson gave for himself, but, since the adjournment, he (Mr. Pope) had been in a position to ask that gentleman what the real purity of the Dover gas was, and, although not allowed to say it as evidence, if Mr. Anderson came and said he purified his gas below 30 grains of sulphur with lime in the condition in which he produced it, he (Mr. Pope) did not believe it. Then they had Newcastle quoted against them, and it was a pity he had not had the opportunity of cross-examining Mr. Pattinson in that case as well as in the Crystal Palace case, because he would like to have known what the quality of the Newcastle-upon-Tyne gas was during the month of April, and how far there was a supply without a nuisance, and with the amount of purity specified by the Act of Parliament. He would have liked to have asked him, from his own report of last April, whether there was not as much variation as between 6 grains and 30; and, therefore, to talk about those which were irregular in their nature as being authorities with regard to that which was to be a continuous operation, was to quote cases which had no relevancy to the point at issue, and which might be put upon the shelf as not being cases on all fours with the present one. He understood his learned friend to say: "You do it at Fulham; do it everywhere else." But did they do it at Fulham? Undoubtedly occasionally they did—that was to say, there were occasions on which persons had visited Fulham who had not found upon the works that nuisance which they would expect to find. He hoped that when the committee visited Fulham they did not afterwards experience any ill effects from having inhaled sulphuretted hydrogen. But, at all events, it only amounted to the fact that at Fulham there did exist conditions which, under certain circumstances and at certain times, appeared to secure comparative immunity from nuisance. At the same time, as he had already said, occasional immunity from nuisance was not sufficient, unless it could be secured that the circumstances which caused that immunity should be constant and continuous, because that was what the legislation provided. Those who had visited Fulham during the last month had visited it during the best time of the year, to begin with, when the make was smallest, when the atmospheric conditions were at the best, when the damp, close weather, which was the most favourable to the development or propagation of a stink, did not exist, and when there was, comparatively, a breeze which would convey any unpleasantness away faster, and distribute it or diffuse it in the surrounding atmosphere. But they had had the evidence of Lord Charles Thynne, of Mr. Veitch, the nurseryman, and of Dr. Barclay, to prove that at times, at all events, and frequently—although at other times it was minimized—the nuisance existed, and existed with great intensity. [Evidence quoted.] Was not the evidence given conclusive against the ungenerous and unfair theory his learned friend threw out—that because it was their interest to create a nuisance that nuisance was created, and for no other reason. It was as much the interest of the company at Bow, which he quoted as a place where there was no nuisance, as it was anywhere else. It was as much their interest at Fulham as anywhere else, and yet at the very time when, if any interest existed in it, there should be a stink, there was not one. When the Referees were there, if the company had had any interest to make things worse than usual, then would have been the time to have done so. It was quite clear, as a fact, that Mr. Vernon Harcourt and Professor Tyndall had been known to be there as Referees, with a view to ascertain the existence of a nuisance, and finding there was none, or thinking there was none, was the best possible proof of the *bona fides*, at all events, with which Mr. M'Minn was endeavouring to carry out his process; because at the very time when it would be most to his interest that the nuisance should be smelt, the least nuisance was found, and the least nuisance was appreciated. If that was the case, did it not answer the whole matter? Taking the balance of advantage, was it worth while to insist upon a process being adopted in the Metropolis in order to accomplish that which Mr. Harcourt said was in itself of no great consequence when it was accomplished? He (Mr. Pope) ventured to think that that which the chairman had pointed out as the real question in the matter might be answered affirmatively—viz., "that some such relief should be given to the gas company, as on the balance of convenience, because they think that the injury to that part of the public which suffers by the process of lime purification is, on the whole, greater than the inconvenience suffered by the consumers and the public by a slight increase of the maximum of the sulphurous compounds." It was admitted the change from a maximum of 20 to a maximum of 40 grains was all that was necessary to get rid of the lime purification, leaving the committee to deal with the question of future invention in any way they might think fit. His learned friend had suggested that, supposing the committee should come to the conclusion that the disadvantage of the nuisance was greater than the advantage of sulphur purification, they should enforce that sulphur purification, and compel the company to remove their stations outside London; in other words, he would read the Act of Parliament as involving not a "reasonable restriction upon the company," but as involving an intention to compel the sacrifice of property and interest, and capital and convenience, which was necessary in order to exclude from the centres of population the stations of The Gaslight and Coke Company. He (Mr. Pope) hoped the time would come when it might be consistent with the requirements of the company to do away with many of those central stations, and to make their gas outside the large area of population; but it was well known that it could not be done in one station, because the risk and the danger of leaving three-fourths of London in darkness for a night, through an accident at that particular station of manufacture, would be too great to be contemplated, even in the face of his learned friend's favourite grievance, sulphur impurity; but supposing there were to be two or three outside stations, they could not spring up in a day. At that moment, as Mr. Trewby had told them, the capital of the company was being expended in the enlargement of Beckton as fast as they could do so. They could not enlarge Fulham, because, notwithstanding his learned friend's contention that there was no nuisance there, the Imperial had been twice refused by Parliament leave to enlarge those works, the inhabitants having protested that that enlargement would involve such a nuisance that they would not endure it. The committee were not asked to legislate that day for that which was to be permanent. The company did not say that circumstances might not arise which would justify Parliament and the authorities in dealing with the question of impurity hereafter; but what they did say was, that the suggestion that they were to be forced to remove their existing stations, by the pressure of a thing such as that, would undoubtedly be so monstrous a suggestion that it could not have emanated from the Corporation of London, or the Metropolitan Board of Works, if they desired to deal fairly and reasonably in this matter. What was to be done in the meantime? Whatever enlargements and improvements The Gaslight and Coke Company underwent, what was to be done with regard to those districts which must have gas, and which would have the nuisance, provided the committee insisted upon having that which, after all, was of no great consequence—gas with a maximum of less than 40 grains of sulphur in 100 cubic feet. In conclusion, the learned counsel said that really appeared to be the whole matter, and he therefore ventured to submit that the question stood exactly where it did before the Whitsuntide holidays, and that the committee would do wisely to adhere to the inclination of opinion they then so kindly expressed.

The committee-room was then cleared. After some time the counsel and parties were again called in, and

The CHAIRMAN said: The committee have decided simply to declare that the preamble of the Bill is not proved.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

THURSDAY, JUNE 21.

(*Before the* MASTER OF THE ROLLS, *and Lords Justices* JAMES *and* BRAMWELL.)

TAYLOR *v.* THE CORPORATION OF ST. HELEN'S.

Mr. ROBINSON, Q.C., and Mr. MABERLY were for the plaintiff; Mr. COTTON, Q.C., and Mr. CHRISTIE were for the corporation; Mr. E. S. FORD was for the water company.

This was an appeal from a decision of Mr. Little, Q.C., as Vice-Chancellor of the Lancaster Chancery Court. An Act of Parliament was passed in 1843, incorporating the St. Helen's Water-Works Company for the purpose of supplying the town of St. Helen's with water. The Act empowered the company to agree with the owners of the lands, springs, and streams which they were thereby authorized to enter into, purchase, and use for the purposes of the water-works, for the absolute purchase for a consideration in money of any such lands, springs, and streams, and provided that such consideration might be in the form of a perpetual annual rent-charge in lieu of a sum in gross. By a deed poll under this Act, dated the 28th of October, 1844, Mr. Samuel Taylor (who is the Lord of the Manor of Eccleston, and the owner of an estate of considerable extent at Eccleston, lying within the limits prescribed by the Act for the exercise of the powers conferred by it), in consideration of a rent-charge to be paid to him, his heirs, and assigns, by the company, granted to the company, their successors and assigns, "All and singular the water-works, dams, and reservoirs, and intended reservoirs in or upon the lands of Taylor, in Eccleston, which watercourses, dams, and reservoirs, and intended reservoirs, were described in the plan annexed to the deed, and were therein coloured blue (which plan was to form and be deemed a component part of the deed), and also the several springs or streams of water flowing into or feeding the said watercourses, dams, and reservoirs, as indicated in the said plan, together with the right and liberty to and for the company, their successors and assigns, solely to take and use the water from the said springs or streams of water, watercourses, dams, reservoirs, and intended reservoirs, for the purposes of the company." The undertaking and the powers of the company became afterwards vested in the Corporation of St. Helen's, under a lease for a term of 5000 years from Dec. 25, 1850. The principal watercourse included in the grant to the company was in part an artificial covered channel, and in part open. Three weirs were, many years ago, constructed on the open part of it, to prevent floods on the lower lands of Mr. Taylor, to enable him to divert and utilize the flood water. The water diverted by these weirs was carried by channels to, and impounded in, a dam, called the Corn Mill Dam, which was used for the purpose of working the manorial corn-mill belonging to the lord of the manor. Early in the year 1851, plaintiff constructed a new reservoir, called the Eccleston Mere, in order to impound a larger quantity of the water diverted by the weirs, it being more than sufficient for the supply of the Corn Mill Dam. The Eccleston weir covers 32 acres of ground, and on Dec. 31, 1851, Taylor granted a lease of it and the Corn Mill Dam, and the right to take water therefrom, to the St. Helen's Canal and Railway Company. The undertaking and rights of that company are now vested in the London and North-Western Railway Company, and the Mere is used by them as a reservoir for the supply of the Sautery Canal. At one point of the principal watercourse granted by the deed of October, 1844, where it runs through a covered channel or culvert, there was what is called a "throttle"—that is to say, for a distance of about 40 feet the size of the channel was contracted by its floor being suddenly raised in height 28 inches, the result being that the flow of the water was obstructed, and the level rendered higher at the upper part of the watercourse, so that more water found its way in time of flood, by means of the weirs and channels leading therefrom into the Mere and the Corn Mill Dam, than would have been the case if the throttle had not existed. The corporation, in the year 1875, removed the throttle, and constructed in place of it an enlarged culvert of uniform gradient. The object of this suit, in which Mr. Taylor and the railway company are plaintiffs, was to restrain the corporation from doing this, and to compel them to restore the throttle. The Vice-Chancellor granted a perpetual injunction to restrain the corporation from enlarging the size or altering the level of the watercourse, and ordered them to restore the throttle. Against this injunction the defendants appealed.

The MASTER of the ROLLS, in giving judgment, remarked that the question was as to the true construction of the grant in the deed of October, 1844. The words must be construed according to their ordinary meaning, unless the context showed that a different meaning ought to be given to them, and the old maxim, that if there were any difficulty or obscurity in the construction of a grant, it was to read most strongly against the grantor, had at the present day very little weight. The grant of a watercourse might mean one of three things. It might mean a grant of the easement or right to the flow or running of the water, or a grant of the channel containing the water, or a grant of the land over which the water flowed. Which of these three meanings was to be adopted must depend on the context. In the present case he thought that the grant was of a corporeal hereditament, and that it meant the channel, pipe, or drain which contained the water, and the water contained in it; and if there were nothing else in the deed, the grantees would be entitled to the channel and the water coming into it by ordinary natural means. Of course, the plaintiff

could not grant the water which flowed into the watercourse from land not his own, for that water was not his to grant; but by the grant of the watercourse he granted any water which flowed into it from off his own land. Then he also granted springs of water, which must mean his own springs. A spring was a definite source of water existing in nature, and it might be above or below the ground; a stream was also something running in a defined course, and the plaintiff granted also the streams of water on his own land. That was the extent of the grant. The defendants claimed to be entitled to, not merely the water in the watercourse and the springs and streams of water, but to all the water which could by any possibility get from the plaintiffs land into the watercourse. His lordship thought that the grant extended only to such water as was granted because it was in the watercourse. If a grant was made of vessels containing fluid, the grantee only got the fluid because it was in the vessel. He had no right to enlarge the vessel for the purpose of getting more fluid into it. If it could be shown that all the water on Mr. Taylor's land had been granted independently of its being incidental to the grant of the watercourse, that would imply a reasonable way of getting it, and would imply a right to enlarge the watercourse. But that was not the grant in the present case. The result was that the defendants had no right to enlarge the existing watercourse, and the decree of the Vice-Chancellor must be affirmed.

Lord Justice JAMES concurred, observing that the grant was of a watercourse actually delineated and coloured blue on the plan annexed to the deed, and he was of opinion that nothing was conveyed but what was so delineated and coloured. And he agreed with the Master of the Rolls that in this case the word "watercourse" meant the existing channel, and that there was no right in the defendants to enlarge it.

Lord Justice BRAMWELL also concurred.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, JUNE 21.

(*Before Vice-Chancellor* MALINS.)

SUTTON *v.* THE BARNET LOCAL BOARD.

Mr. LOCOCK WEBB, Q.C., and Mr. BOSANQUET, appeared for the plaintiff; Mr. GLASSE, Q.C., Mr. J. PEARSON, Q.C., and Mr. CHARLES MITCHELL for the defendants.

This was an action brought by the plaintiff, who is a farmer at Totteridge, in the county of Hertford, for an injunction to restrain the Local Board of Barnet from committing a nuisance by allowing the sewage of the district to flow into a stream running by the plaintiff's farm. The injunction was granted by Justice Field in August, 1876, and upon a motion to dissolve that injunction, the defendants gave an undertaking not to continue or repeat any nuisance by causing or permitting the sewage of the district to flow into the stream. A motion was now brought on, on behalf the plaintiff, that four members of the local board might stand committed to prison for breach of that undertaking, and also that a commission of sequestration might issue against the estate of the defendants, the local board. An action for damages had been brought by the plaintiff against the defendants, which was tried at Hertford, and that action resulted in a verdict for the plaintiff, with £75 damages, and costs. It was not now sought to enforce the commitment of the defendants, but only that they should be ordered to pay the costs. The motion was opposed, on the ground that in a case like this, where the defendants had been doing all in their power to remove the nuisance, it was unjustifiable on the part of the plaintiff to ask that the four members of the board should be committed, and that they ought not to be ordered to pay the costs.

The VICE-CHANCELLOR said it appeared from the evidence in this case that the stream now in question was formerly so pure that the cattle used to drink from it, and that the water was rendered impure and unfit for use by the sewage which was allowed to flow into it from the defendants works. That a nuisance had been caused was evident from the result of the action at Hertford, and when the defendants moved to dissolve the injunction granted to restrain a continuation of the nuisance, an undertaking was given by the board not to allow this nuisance to continue. The board meeting at which this undertaking was confirmed was attended by the four gentlemen who were now the objects of the motion to commit. It was quite clear that the board had no intention whatever of acting contumaciously; but, on the contrary, that they had done all they could to abate the nuisance. There was, however, no doubt, upon the evidence, that the steps they had taken were not effectual, although the nuisance might, in some degree, have been abated. Under these circumstances the defendants ought never to have allowed this case to go on, but should have submitted and paid the costs, the only object of the plaintiff being to enforce the undertaking already given. If this motion had been merely for a sequestration, it would have been a matter of course; but the plaintiff, not satisfied with that, moved also for the committal of the personal members of the board who authorized the undertaking. That portion of the application was wholly unnecessary and unjustifiable; and his lordship agreed with the learned counsel for the defendants in thinking that several clauses in the Local Board of Health Act were intended expressly to protect the persons forming the different boards from any personal liability. Under all the circumstances, he should order the local board to pay the costs so far as regarded the sequestration, but he should not give costs against the individual members of the board in respect of the motion to commit.

METROPOLIS GAS SUPPLY.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the Vestry of St. Pancras, during the month of May:—Maximum light, estimated by sperm candles, according to the Act—16·8. Minimum light, sperm candles—15·8. Average light, sperm candles—16·1. Traces of ammonia, indicated by turmeric test-paper—Traces only on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none on any occasion. Sulphur, 10·44 grains per 100 cubic feet.

METROPOLIS WATER SUPPLY.

Major Bolton reports that the state of the water in the Thames and Lea was good during the month of May. The water in the River Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was good during the month. The highest flood state of the river was 1 foot 3 inches above the (6 feet) summer level, and the lowest was 3 inches below summer level. The highest temperature of the water taken at Seething Wells was 58°, and the lowest 48°, while the highest temperature of the air at the same place was 69°, and the lowest 43°. The condition of the water in this part of the river was good on 11 days, indifferent on 18 days, and bad on 2 days during the month. The highest flood state was 2 feet 1 inch above, and the lowest 7 inches above summer level. These observations were made daily at 9 a.m. The rainfall for the month was 2·29 inches.

DR. WALLACE ON THE AITKEN AND YOUNG PROCESS.

The system of enriching poor, or comparatively poor, gas which has been patented by Messrs. Aitken and Young, and which has, during the last twelvemonth, received a great deal of attention from the gas managers in the West of Scotland, has just been reported upon by Dr. Wallace, F.R.S.E., the gas examiner for the city of Glasgow, a gentleman who deservedly ranks high in the science and art of gas manufacture and gas illumination. As the report prepared by that gentleman is one of very great value, we hasten to place a comprehensive summary of it before the notice of our readers.

Dr. Wallace visited the Hamilton Gas-Works, where the apparatus had been erected, at stated intervals from the 26th of March till the 24th of April of the present year, and, with the assistance of the manager, conducted practical experiments with different kinds of coal. [We have been informed that the works were visited by Dr. Wallace on somewhere about ten separate occasions during the progress of the experiments.] The first actual trial was made with the mixture of third-class parrot coal and shale ordinarily used in the works, in the proportion of 65¼ cwt. of parrot and 15¾ cwt. of shale, or 80·6 and 19·4 per cent. By the ordinary process this mixture yielded gas at the rate of 8870 cubic feet per ton; and, as tested by the standard burner used in Glasgow, the gas had an illuminating power of 22·81 candles, which gives 694 lbs. of sperm as the equivalent of a ton of the mixed material. Employing the same mixture of raw materials, Dr. Wallace then tried the new process for a week, and the result was 9012 cubic feet of 26·60-candle gas per ton of the mixture. The sperm equivalent of a ton of the mixture in this instance was 822 lbs., and the gain was 18·4 per cent. He continued the new process for three days longer, and eventually an illuminating power of 29·2 standard candles was reached; but he did not base any calculations upon this high result. From this and other observations, however, it appeared to Dr. Wallace that the full effect of the new process was only obtained after the lapse of some time, and that, on the other hand, when the old process was resumed the gas did not fall to its normal illuminating power for several days.

As is very proper, Dr. Wallace is careful to give some consideration to the question of the quality of the tar which is finally obtained by this new process. He says that the tar from the analyzer is somewhat thicker and blacker than that ordinarily produced from the same coal, and that it contains, as might be expected, a smaller proportion of volatile hydrocarbons. In the experiments just referred to, the tar obtained by the old process gave 3·8 per cent., and that by the new process 1·7 per cent. of crude naphtha, when distillation was resorted to by the action of open steam. Of course, this is a most important feature to be considered in estimating the value of the new process.

The second series of trials involved the use of Provanhall coal alone. It was of very inferior quality, and contained at least one-fourth of its weight of splint coal. Experimenting first with the new process, which he employed for a week, Dr. Wallace obtained an average yield of 8083 cubic feet of gas per ton of coal, the illuminating power of which was 28·55 candles, the equivalent in sperm being 791 lbs. per ton of coal. The ordinary process was then employed for five days, the results of which were—8235 cubic feet of gas per ton of coal; illuminating power of same, 25·51 candles; sperm equivalent, 720 lbs.; the new process in this instance only showing a gain of 10 per cent. But Dr. Wallace considers it right to say that, by the time this experiment was made, the hydraulic main and all the connexions had been coated with a non-conducting composition—thus preventing, to a certain extent, the absorption of the volatile hydrocarbons by the tar—and that the time allowed for the experiment was too short to secure the full advantage of the new process. He expresses himself as satisfied that, but for these circumstances, a greater gain would have been obtained.

Splint coal alone was then employed for a third series of experiments, but in a few days after they were commenced the complaints as to the quality of the gas were so loud and numerous that the operators were reluctantly compelled to abandon the use of this coal before any satisfactory and reliable results were obtained.

With regard to the means employed for testing the resulting gas, Dr. Wallace remarks that the examinations for illuminating power were made both at the gas-works and at a testing-station, which had been fitted up at the distance of about a mile from the works, and quite outside the town of Hamilton. Trials made there, some of them in very cold weather, satisfied him that the gas was practically permanent, the loss of illuminating power not exceeding from 0·45 to 0·75 of a candle. Dr. Wallace also made estimates of the durability, absorption by bromine, and specific gravity of the gas, and his determinations by these various methods corresponded with the illuminating power observed by the aid of the photometer.

Naturally enough, he adds some remarks on the theory of this new process. The principle which it is desired to establish by means of the process is, that gas tar, condensed in the ordinary way, carries with it a certain proportion of the volatile hydrocarbons included in the general term naphtha; and practical experience, he says, amply bears this out. If gas, he goes on to say, instead of being cooled slowly, is rapidly condensed, for instance, by means of a coil of pipes immersed in cold water, the illuminating power is so much reduced as to make the gas practically useless. Again, if the hydraulic main of a gas-works be exposed to a keen north-east wind, the illuminating power of the gas falls two or three candles. As an illustration of the power of liquid hydrocarbons to absorb vapours of similar compounds existing in gas, Dr. Wallace states that when, many years ago, he attempted to prevent evaporation in his experimental meters by having a thin film of heavy paraffin oil on the top of the water, the gas was deteriorated to a very serious extent. That volatile hydrocarbons in the form of vapour exist in coal gas is well known; indeed, he remarks that the first specimen of benzole ever made was obtained by Faraday by the compression of gas; and the object of the gas manager is to retain these vapours, while separating the heavier compounds in the form of tar. This object is effected in a satisfactory manner by the apparatus employed at the Hamilton Gas-Works, but he is not without hope that experience will suggest some useful modifications of the apparatus, and possibly reduce its dimensions; and he concludes by remarking without reservation that the process is undoubtedly a great step in the art of gas-making.

GAS COAL FOR HOLLAND.—It was rumoured on the Glasgow Exchange last week that orders for a large quantity of Scotch cannel coal of the second class, for shipment to Holland, have just been placed by two coal-shipping firms in Glasgow. This fact, along with other causes, has had the effect of reducing the available supply of Scotch cannel coal to a considerable extent. It is stated that the large increase in the foreign exportation of that variety of coal this season is principally owing to the low prices that were current in Scotland last year. The owners of the cannel collieries, finding the home market so unprofitable, have endeavoured, and so far have succeeded, in developing a trade amongst the gas-consuming cities of the Continent.

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